DOCUMENT RESUME

ED 367 535 SE 053 937

AUTHOR	Cutcliffe, Stephen H., Ed.
TITLE	Science, Technology & Society, 1991-1992.
INSTITUTION	Lehigh Univ., Bethlehem, PA. Technology Studies Resource Center.
REPORT NO	ISSN-0275-8075
PUB DATE	91
NOTE	211p.
AVAILABLE FROM	Science, Technology & Society Program, 327 Maginnes Hall, 9 W. Packer Ave., Lehigh University, Bethlehem, PA 18015.
PUB TYPE	Collected Works - Serials (022)
JOURNAL CIT	Science, Technology & Society; n83-93 Apr 1991-Dec 1992
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Course Descriptions; Cultural Influences; Educational Change; Foreign Countries; Higher Education; Interdisciplinary Approach; Liberal Arts; Newsletters; *Science and Society; *Science Curriculum; Science Education; Social Influences; Sociology; *Technology Education; Undergraduate Study; *Womens Studies
IDENTIFIERS	China; Japan; Lehigh University PA; *Technological Change

ABSTRACT

This document contains issues 83-93 of the curriculum newsletter of Lehigh University's Science, Technology, and Society (STS) program. Each issue contains articles addressing issues relative to STS, course syllabi, reader responses, and announcements. Issue No. 83 discusses establishing an interdisciplinary minor in technology studies at Lafayette College (Pennsylvania) and includes syllabi for courses entitled: Senior Colloquia; Technological Catastrophies; History of Technology; Computers and Society; and The Engineering Method. Issue No. 84 concerns canon in the age of a new technology, the progress of STS in school science, and a syllabus for a course entitled: Philosophy, Technology, and the Future. Issue No. 85 considers the sociology of technology, a conference on the influence of Japanese/American culture on technological innovation in advanced materials, STS related education in China, and STS activities in Japan. Issue No. 86/87 addresses women's studies, with relation to the transformation of the undergraduate curriculum; and a syllabus for a course entitled: Science in Society. Issue No. 88/89 describe an undergraduate program profile for STS studies at Rensselaer Polytechnic Institute and syllabi for courses entitled: Introduction to Science and Technology Studies; Cross-Cultural Perspectives on Science and Technology; History of Science and Technology; Decision Making; The Social Relations of Science; and Risky Technologies. Issue No. 90 identifies two factions within the STS movement and the sociological revolution, and presents syllabi for courses entitled: History of American Technology; and Culture and Technology: A Historical Perspective. Issue No. 91 concerns STS as a social movement; the development of STS at Tshinghua University, Beijing, China; garbage dumps and the chemistry and politics of hazardous waste; and a syllabus for a course entitled: Hazardous Waste and Public Policy Making. Issue No. 92/93 contains articles by Steve Fuller on the sociological revolution in STS and the status of STS as an interdisciplinary field, and syllabi for courses entitled: (1) Technology and Human Values; and (2) The American Dream of a Perfect World. (MDH)

ED 367 535

Science, Technology & Society

Curriculum Newsletter of the Lehigh University STS Program & Technology Studies Resource Center

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Guest Editor: Joseph R. Herkert
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No. 83, April 1991
ISSN: 0275-8075

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TECHNOLOGY STUDIES AT LAFAYETTE COLLEGE

A SPECIAL THEME ISSUE

This issue profiles the Technologies Studies minor program at Lafayette College, Easton, Pennsylvania. Professor Joseph Herkert's introductory essay summarizes the implementation of the program; outlines its philosophy, structure and administration; and concludes with a brief discussion of ongoing questions and issues. I would like to thank our guest editor for this issue, Professor Herkert, Director of the Lafayette Technology Studies Minor, for contributing the lead essay and selecting and soliciting representative course syllabi from his colleagues for inclusion. SHC, Editor

ESTABLISHING AN INTERDISCIPLINARY MINOR IN TECHNOLOGY STUDIES AT A LIBERAL ARTS COLLEGE*

Introduction

While Science, Technology and Society (STS) programs have been in existence at some U.S. colleges and universities for over twenty years (Cutcliffe 1990), faculty at other institutions have only recently begun efforts to establish such programs. Barriers to these efforts often include a lack of funding, poor institutional support, and hostility towards interdisciplinary teaching and research (Lovitts and Champagne 1988). One vehicle that has been successfully utilized in making progress toward overcoming or working around such barriers is the establishment of an interdisciplinary minor program in an STS-related area (Mack 1987; Lovitts and Champagne 1988). Minor programs provide "institutional legitimacy" to STS efforts, as well as a means of drawing together faculty with STS interests and of advertising to students the availability of STS courses (Mack 1987).

In this essay I discuss implementation of an interdisciplinary minor in Technology Studies at

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Lafayette College. Following an overview of the College's course offerings in the technology studies area, I describe the philosophy, structure, and administration of the minor program and the history of its implementation and revision. I conclude with a discussion of some ongoing problems and progress toward their solution.

Technology Studies at Lafayette College

Lafayette College is a private, coeducational undergraduate institution offering degree programs in engineering, the natural and social sciences, the humanities, and the arts. About twenty percent of the College's 2,000 students are enrolled in Bachelor of Science degree programs in engineering or in an innovative Bachelor of Arts in Engineering degree program.

Lafayette's engineering faculty, numbering roughly thirty-five full time members, gives it an unique advantage over most other "liberal arts" colleges with respect to offering courses in the technology studies area (Herkert 1990). In addition, a number of the College's course offerings, in such fields as American Civilization, Art, Computer Science, and History, are focused upon the historical and societal context of technology. All Bachelor of Arts (A.B.) degree recipients, including A.B. in Engineering majors, are required to take an interdisciplinary, values-oriented "senior colloquium" course. Approximately forty percent of the courses offered as senior colloquia have a significant technology studies component.

In 1983, the College received a major grant from the Alfred P. Sloan Foundation under its "New Liberal Arts" program, followed by a renewal grant in 1986. The Sloan grants have funded a number of faculty development activities, resulting in several new interdisciplinary courses in the area of technology studies. A number of these courses have been developed by engineers with the goal of increasing the "technological literacy" of liberal arts majors. Other Sloan courses have been "technology clinics" wherein interdisciplinary teams of engineering and liberal arts students work together, under the supervision of an engineering faculty member and a non-engineering faculty member, on the solution of a technological problem posed by a real-world client. Still other Sloan courses have been developed by interdisciplinary teams of faculty in conjunction with the senior colloquium program.

Philosophy, Structure, and Administration of the Minor Program

The minor in Technology Studies is designed to provide students in all major fields with exposure to the methods utilized by engineers, as well as insights into the historical and societal context of technology. The minor thus reflects the "tension" that exists at Lafayette between those faculty members who believe technology studies courses should emphasize technological literacy for liberal arts majors, including most of the engineering faculty and many of the non-engineers who have participated in the Sloan program, and those faculty members in engineering, humanities, and social sciences who have developed departmental and interdisciplinary courses which focus on the societal and historical context in which technology is developed and applied.

As Steve Cutcliffe (1990) has argued, an integrated approach, incorporating both the methodology and context of science and technology, is essential if students in STS programs are to gain a thorough understanding of science and technology:

> ...we should strive for an increasingly sophisticated understanding of the internal workings of science and engineering, yet one that places that understanding of science and technology in their societal context.

Although effectively integrating the two perspectives on technology studies has proven to be an ongoing challenge, the fact that both viewpoints exist at Lafayette has ultimately strengthened the minor program by providing students with a wide variety of course selections drawn from each.

The current requirements for the minor in Technology Studies, which became effective with the Class of 1992, are listed in Appendix I. Candidates for the minor must take two required courses, "Technology, Values and Society" and "History of Technology," as well as a methodological elective chosen from among introductory engineering courses and interdisciplinary courses stressing technological literacy, a contextual elective dealing with the history or social impacts of technology, and two additional courses chosen from the methodological or contextual content areas or from among the technology-focused senior colloquia. Typically, of the six courses selected for the minor, at least two are taught by engineering faculty ("Technology, Values and Society" and the methodological elective) and at least two by non-engineering faculty ("History of Technology" and the contextual elective), thus providing the student a balance of technical and humanistic perspectives on technology.

The only course created specifically for the minor is "Technology, Values and Society," which was developed and is taught by the author. It is an interdisciplinary course open to all Lafayette students with sophomore standing or above, including B.S. engineering majors, who may take the course as a humanities/social sciences elective. Enrollment is typically comprised of about sixty percent non-engineering students and forty percent engineering students. The course covers such topics as conflicting views on technology, technology forecasting and assessment, control of technology, and technology and global issues. Throughout the course, students are challenged to examine critically their personal and discipline-based views on technology, and to work collaboratively with students from different backgrounds toward greater understanding of controversial technological issues. The course employs a number of collaborative learning strategies, including small group discussions/problem solving, roleplaying exercises, group-designed class sessions, and peer grading of student presentations (Herkert 1991). Students also participate in a writing across the curriculum program in which they meet with trained student writing associates to review drafts of their papers. An STS course taught by an engineer, "Technology, Values and Society" thus functions as a link between the methodological and contextual underpinnings of the minor program.

As an interdisciplinary minor, the Technology Studies program does not, as such, have a budget, nor does it possess faculty lines. A modest amount of funding (approximately $3,800 in academic year 1991/92) is allocated from the College's library budget for purchase of books and periodicals in the technology studies area. Two academic departments, Civil Engineering and History, are committed to offering on a regular basis the required courses for the minor, "Technology, Values and Society" and "History of Technology," respectively. While many of the elective courses for the minor, some of which are major requirements in various fields, are offered on a regular basis, scheduling of these courses is entirely at the discretion of the individual faculty members and their departments. The faculty coordinator of the minor, who is responsible for its administration and for advising of students, receives no compensation or released time from other responsibilities.

History of Minor Program

The minor was conceived of during the 1985-86 academic year by two engineering professors. One of the two taught a course in

the history of technology and served as a director of the College's original Sloan grant, while the other had developed, with prior Sloan support, a course entitled "The Bridge," which was designed to introduce non-engineering students to engineering methods. Their original proposal for a minor called for selection of six courses from three content areas--Methodology, Historical Perspective, and Impact & Issues--with a minimum of one course and a maximum of three courses to be selected from each area. This proposal was withdrawn when it became apparent that some members of the faculty felt it lacked rigor due to the fact that it had no required courses.

A second proposal was prepared which expanded the number of elective courses and designated a required course in each content area. "The Bridge" and "History of Technology" were the proposed requirements in the Methodology and Historical Perspective content areas, respectively. As no suitable course was available in the Impact & Issues content area, this second proposal called for a technology-focused senior colloquium as the third required course. This proved to be problematic as some faculty members questioned the appropriateness of utilizing a senior colloquium course, intended as a cap-stone experience for the A. B. major, as a minor requirement.

In the fall of 1986, the author joined the College as the Dana Faculty Fellow in engineering. My hiring was made possible by a grant from the Charles A. Dana Foundation which enabled the College to hire four new junior faculty members, one each in engineering, natural sciences, humanities and social sciences, with background and interest in interdisciplinary teaching and research. The position for which I was hired, though based in engineering, was advertised under the heading of "Technology Studies." One of my first responsibilities was to develop a new course, "Technology, Values and Society," which became the third required course for the proposed minor.

The proposed minor was approved by the curriculum committee and adopted by the faculty during the Fall 1986 semester. The first four students to graduate with the minor were members of the Class of 1989. Two additional students graduated in 1990 and three others in 1991.

Revision of Minor Requirements

Despite the repeated iterations necessary in obtaining their approval, the original requirements for the minor were, unfortunately, flawed in a number of ways. Designed by engineers with an interest in promoting technological literacy among liberal arts majors, the electives were top-heavy with engineering courses, such as "Introduction to Electrical Circuits" and "Nature of Engineering Materials," which had very little chance of appealing to the target audience. Even "The Bridge," which had been specifically designed for this audience, was unsuccessful in attracting sufficient numbers of students to justify its existence. Indeed, "The Bridge" was never offered following the adoption of the minor program, even though it was listed as a minor requirement. Instead, students pursuing the minor were permitted to substitute an engineering course, "An Introduction to Engineering," for "The Bridge."

Of the nine students who graduated with the minor from 1989-1991, four were engineering students while the remainder majored in such fields as History, Psychology, Economics and Business, and American Civilization. Of the five non-engineering majors, however, all but one began their Lafayette studies as engineers before changing their major to the liberal arts. It became clear that the minor, while successful in attracting engineering students and former engineering majors, had largely failed in its original intent to attract A.B. majors who might otherwise not consider the study of technology.

Feedback from students and advisors indicated that the inclusion of a large number of engineering courses in the electives had given the misleading impression that the program was an engineering minor, and liberal arts majors had neither the background nor the desire to take courses designed for engineering students.

In the fall of 1988, upon the retirement of the original coordinator of the minor, the author was appointed coordinator, and set out to revise the minor requirements so as to de-emphasize the role of engineering courses and create a better balance between courses that focus on technological literacy and courses that focus on the societal and historical context of technology. As an untenured assistant professor, I encountered even more barriers to revising the minor than had its original proposers in seeking initial approval for the program. These problems included the customary turf battles which go hand in hand with interdisciplinary programs. Nevertheless, after several aborted attempts, the current requirements for the minor were approved by the Curriculum Committee in December 1989 and adopted by the faculty in the spring of 1990. The new requirements (Appendix I), which are effective with the Class of 1992, are designed to make the minor more attractive to non-engineering majors, while maintaining a balance of methodological and contextual perspectives on technology.

Progress Toward Solving Some Ongoing Problems

Although the past five years have had some difficult moments, the Technology Studies program at Lafayette is now well-established as a viable interdisciplinary minor. However, a number of problems persist.

Because the program has no budget, curriculum development and course offerings are by and large controlled by others. Most interdisciplinary curriculum development in the technology studies area is funded by the Sloan project, which has as its principal focus the creation of courses emphasizing technological literacy. Until very recently, there was little or no discussion with the coordinator of the minor concerning the development and scheduling of such courses. There has also been a tendency on the part of some administrators and faculty members to dismiss the relevancy of contextual technology studies courses, even though such courses, despite rigorous requirements, have had consistently high enrollments.

The lack of direct funding for the Technology Studies Minor has, to some degree, been offset by the fact that the author, as Dana Fellow, has had the opportunity to develop a second interdisciplinary technology studies course, a senior colloquium entitled "Technological Catastrophes." Other faculty members have also created new interdisciplinary courses, although funding for such courses has often been hard to come by unless the developer agrees to offer the course as a senior colloquium. Upon the retirement of the engineering professor who taught "History of Technology," the History Department hired a historian of technology who also holds an undergraduate engineering degree, thus forging yet another link between the contextual and methodological stems of the minor program. New discipline-based courses have also recently been developed by faculty in the departments of Psychology and Government and Law.

A second ongoing problem relates to the lack of response to the minor by students who are not, nor never were, engineering majors. Efforts are underway to recruit more non-engineering students to the minor by publicizing it to the campus community. For example, the Technology Studies Minor program co-sponsored the College's symposium on environmental issues held during the Spring 1991 semester. Attempts have also been made to foster a relationship with the other interdisciplinary programs at

Lafayette College. In addition to Technology Studies, the College offers interdisciplinary minors in such fields as Black Studies, Womens Studies, and East Asian Studies. The Admissions Office is currently publishing a brochure for prospective students which highlights the opportunities for interdisciplinary study at Lafayette, including the Technology Studies Minor. In addition, students pursuing the minor have been invited to join the Leonardo Society, a student organization associated with the A.B. in Engineering Program. Such efforts, along with the revised minor requirements, are beginning to show results. About three students from each of the Classes of 1992 and 1993 are currently pursuing the minor. Of these six, only one is an engineering student, while three are former engineering students.

Conclusion

The experience at Lafayette College has been that a successful Technology Studies Minor program can be developed with limited financial and faculty resources through creative integration of existing discipline-based courses and new, interdisciplinary courses. The single most important factor in achieving this success has been in striking a balance which is agreeable to both faculty and students between courses emphasizing technological literacy and courses exploring the social, economic, political, ethical, or historical dimensions of technology.

Engineers, like our colleagues in the humanities, social sciences, and natural sciences, can make an essential contribution to the education of liberal arts students. On the other hand, all students, engineers and non-engineers alike, stand to benefit significantly from exposure to STS courses which, by placing science and technology in historical or societal context, serve the dual function of integrating the various disciplinary perspectives on science and technology, as well as helping to prepare both experts and non-experts for mutual understanding in a technological age.

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Lafayette College

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*This paper was originally presented at the 6th Annual Technological Literacy Conference, National Association for Science, Technology & Society, February 1-3, 1991, Washington, D.C.

References

Cutcliffe, Stephen H., "The STS Curriculum: What Have We Learned in Twenty Years?" *Science, Technology, & Human Values* 15 (1990): 360-72.

Herkert, Joseph R., "Science, Technology and Society Education for Engineers," *IEEE Technology and Society Magazine* 9 (1990): 22-26.

Herkert, Joseph R., "Safety, Ethics and Legal Aspects of Engineering: A Collaborative Learning Approach," 1991 ASEE Annual Conference Proceedings, American Society for Engineering Education, 1991.

Lovitts, Barbara E. and Audrey B. Champagne, *Innovating in Higher Education,* American Association for the Advancement of Science, Office of Science & Technology Education, 1988.

Mack, Pamela E., "Building a Program Gradually: Science, Technology and Society at Clemson University," *Proc. of Conference on the State of S.T.S. in North America, Western Europe, and Australia*, Worcester Massachusetts, 1987.

APPENDIX I

REQUIREMENTS FOR THE TECHNOLOGY STUDIES MINOR

LAFAYETTE COLLEGE

A minor in Technology Studies consists of at least six approved courses, beginning with Interdisciplinary 222: Technology, Values and Society and History 215: History of Technology. Elective courses may be selected from two broadly organized content areas: 1) Methodological Studies and 2) Contextual Studies. At least one course must be chosen from each content area. An approved senior colloquium may be utilized as an elective course, and A.B. majors are encouraged to do so. B.S. majors are permitted to enroll in senior colloquia courses only on a space available basis. One approved Independent Study may be selected as an elective course.

METHODOLOGICAL STUDIES

Engineering Science 111: Graphics
Engineering Science 225: Engineering Professionalism and Ethics
Interdisciplinary 321, 322: Technology Clinic
Interdisciplinary 361: The Gothic Cathedral-Structural Rationalism in Medieval Architecture
Interdisciplinary 365: The Engineering Method

CONTEXTUAL STUDIES

American Civilization 241: Work, Culture and Society in Industrial America
Art 125, 126: History of Architecture
Computer Science 200: Computers and Society
History 250: Technology and the American Imagination

SENIOR COLLOQUIA

Interdisciplinary 472: Nuclear Arms Race
Interdisciplinary 473: Science and Diplomacy of the Bomb
Interdisciplinary 474: Issues in Health Care in a Technological Society
Interdisciplinary 479: Issues on Hazardous and Toxic Materials
Interdisciplinary 480: Water Resources and Society
Interdisciplinary 484: The Printing Press and the Computer: Technology and the Historical Imagination
Interdisciplinary 490: Analysis of Historic Structures
Interdisciplinary 491: Technological Catastrophes
Interdisciplinary 493: The Development of the Bomber
Interdisciplinary 494: Television as a Cultural Institution
Interdisciplinary 495: Biotechnology, Genetic Engineering and Social Implications

COURSE SYLLABUS

SENIOR COLLOQUIUM: TECHNOLOGICAL CATASTROPHES

INDS 491
1991

Joseph R. Herkert
Department of Civil Engineering

Course Description:

The recent past has seen a succession of highly publicized accidents involving advanced technologies. The most notable of these catastrophes are the Bhopal chemical leak, the space shuttle *Challenger* explosion, and the Chernobyl nuclear accident. Using these or other examples of catastrophic failures in technological systems as case studies, the colloquium will consider such questions as: What is acceptable risk? What are the important differences and similarities between recent technological catastrophes? Are large-scale technological disasters avoidable?

Course Requirements:

1. Preparation, class attendance, and regular participation in class discussions (30% of course grade).
2. Two take-home essay examinations (each comprising 25% of course grade).
3. Participation in a group project (20% of course grade).

Required Text:

Perrow, C. *Normal Accidents: Living with High-Risk Technologies*. New York, N.Y.: Basic Books, 1984.

Additional Required Reading:

The following items will be placed on reserve in Skillman Library or, if possible, distributed by the instructor as separate handouts:

Ahearne, J. "Nuclear Power after Chernobyl." *Science* 236 (1987): 673-79.

Atomic Industrial Forum. *Multiple Barrier Containment: Significant Differences Between U.S.--Soviet Reactors* (AIF, 1986).

Bavaria, J. "An Environmental Code for Corporations." *Issues in Science and Technology* (Winter 1989-90): 28, 30-31.

Bell, T. and K. Esch. "The Fatal Flaw in Flight 51-L." *IEEE Spectrum* (February 1987): 36-51.

Bell, T. and K. Esch. "The Space Shuttle: A Case of Subjective Engineering." *IEEE Spectrum* (June 1989): 42-46.

Chalk, R. "Making the World Safe for Whistle-Blowers." *Technology Review* (January 1988): 48-57.

Clarke, L. "Oil-spill Fantasies." *The Atlantic Monthly* (November 1990): 65-77.

Clines, F. "Chernobyl Shakes Reindeer Culture of Lapps." *New York Times* (September 14, 1986).

Donaldson, T. "The Ethics of Global Risk." *IEEE Technology and Society Magazine* (June 1986): 17-21.

Gale, R. "Chernobyl: Answers Slipping Away." *Bulletin of the Atomic Scientists* (September 1990): 19-23.

MacKinnon, B. "Pricing Human Life." *Science, Technology & Human Values* (Spring 1986): 29-39.

Marples, D. "Revelations of a Chernobyl Insider." *Bulletin of the Atomic Scientists* (December 1990): 16-21.

McConnell, M. *Challenger: A Major Malfunction.* Garden City, N.Y.: Doubleday, 1987.

Park, C. *Chernobyl: The Long Shadow*. London and New York: Routledge, 1990.

Perrow, C. "The Habit of Courting Disaster." *The Nation* (October 11, 1986).

Plough, A. and S. Krimsky. "The Emergence of Risk Communication Studies: Social and Political Context." *Science, Technology & Human Values* (Summer/Fall 1987): 4-10.

Shrivastava, P. *Bhopal: Anatomy of a Crisis.* Cambridge, Mass.: Ballinger, 1987.

Slovic, P. "Perception of Risk." *Science* 236 (1987): 280-85.

Sweet, W. "Chernobyl: What Really Happened." *Technology Review* (July 1989): 43-52.

Wilson, R. and E. Crouch. "Risk Assessment and Comparisons: An Introduction." *Science* 236 (1987): 267-70.

Course Outline and Assignments:

Date	Topic/Activity	Reading Assignment
	I. RISK, ACCIDENTS AND SAFETY	
1/29	Course Overview	
1/31	Living Dangerously	Perrow, *Normal Accidents*: 3-14, 105-08; Shrivastava, *Bhopal*: 7-24
2/5	Normal Accidents	Perrow, *Normal Accidents*: 15-61

2/7	Complexity and Coupling	Perrow, *Normal Accidents*: 62-100
2/12	Risk Assessment	Wilson & Crouch, "Risk Assessment and Comparisons"; Slovic, "Perception of Risk"
2/14	The Risks of Risk Assessment	Perrow, *Normal Accidents*: 304-28; MacKinnon, "Pricing Human Life"

II. CHALLENGER

2/19	Video: "The Real Stuff"	Perrow, *Normal Accidents*: 258-61, 269-71; McConnell, *Challenger*: 176-204
2/21	Causes of the Challenger Explosion	Bell and Esch, "The Fatal Flaw in Flight 51L"
2/26	Risk Assessment and the Shuttle	Bell and Esch, "The Space Shuttle"
2/28	Focus on Values: Whistle-blowers	Chalk, "Making the World Safe for Whistle-blowers"

III. CHERNOBYL

3/5	Video: "Back to Chernobyl"	Sweet, "Chernobyl"
3/7	Causes of the Chernobyl Accident	Ahearne, "Nuclear Power After Chernobyl"; AIF, "Multiple Barrier Containment"

MONDAY EVENING 3/11 LANDIS LECTURE (See Note Below)

3/12	Chernobyl's Legacy	Gale, "Chernobyl"; Marples, "Revelations of a Chernobyl Insider"
3/14	Focus on Values: Cross-Cultural Risk Distribution	Park, *Chernobyl*: 129-35; Clines, "Chernobyl Shakes Reindeer Culture of Lapps"
3/19	Guest Lecture: The Dalkon Shield	

3/21 NO CLASS (See Note Below)--Mid-Term Exam Due On Friday, March 22

3/26 & 3/28 SPRING RECESS: NO CLASS

IV. BHOPAL

4/2	Video: "Who Shall We Tell?"	Perrow, *Normal Accidents*: 101-5, 120-22.

4/4	Causes of the Bhopal Accident	Shrivastava, *Bhopal*: 35-61
4/9	Impacts of Bhopal	Shrivastava, *Bhopal*: 63-84
4/11	Focus on Values: Exporting Risk	Donaldson, "The Ethics of Global Risk"

V. EXXON VALDEZ

4/16	Video: "Anatomy of an Oil Spill"	Perrow, *Normal Accidents*: 170-77, 196-201, 229-31
4/18	Causes of the Spill	News clippings and articles to be brought to class by students
4/23	After the Spill	Clarke, "Oil-Spill Fantasies"
4/25	Focus on Values: Corporate Ethics & Risky Technology	Bavaria, "An Environmental Code for Corporations"

VI. LIVING WITH RISKY SYSTEMS

4/30	Abandon, Restrict or Tolerate?	Perrow, *Normal Accidents*: 329-52
5/2	Focus on Values: Are Catastrophes Inevitable?	Perrow, "The Habit of Courting Disaster"
5/7	NO CLASS (See Note Below)	
5/9	Who should Decide?	Plough and Krimsky, "Risk Communication Studies"

Final Exam Due By 4:00 P.M. On Friday May 17

Note: All students are required to attend the Landis Lecture by Lester Brown, President of the Worldwatch Institute, at 8:00 P.M. on Monday March 11 in Kunkel Auditorium **and** at least one of the other lectures held in connection with the Environment Symposium to be held throughout the semester. Environmental impacts of technology are central to the theme of the course; knowledge obtained through attendance at the environment symposium could be useful in preparing your group projects and/or in framing your responses to questions on the essay examinations. In consideration of the out-of-class assignments, the regular class meeting will be cancelled twice during the semester.

Guidelines for Group Projects:

Each group will consist of four to five students who will be responsible for planning and leading an entire class period on their assigned topic, one of several in the course with a "focus on values." The class session will be planned in consultation with the instructor, but it is the responsibility of the student group to research the topic and obtain the information necessary for the class presentation. Particular emphasis should be placed upon illuminating the questions concerning values choices and conflicts raised by the topic. Although each topic falls within a particular section of the course outline, the group project need not be limited to the catastrophe under consideration in that section. The class topics to be handled by the student groups are indicated on the syllabus with the preface, "focus on values." Students will be given the opportunity to rank the topics in order of preference. Final assignment of groups and topics will be at the discretion of the instructor.

Format

Five-person groups must utilize the entire class period on the assigned project date. Four-person groups must use at least sixty minutes of class time, but may use the entire period if so desired. You are allowed considerable leeway in the organization of the class, but two requirements should be kept in mind: all members of the group are expected to participate equally in the project, and provision must be made for meaningful and significant class participation. Up to one half of the class time utilized may consist of an appropriate film or guest speaker. If a guest speaker is invited, the group should be careful to explain that the speaker's time and role in the class will be limited.

The instructor has selected a reading assignment for each topic. The groups, at their discretion, may utilize this reading assignment or substitute an alternative one. If you would like the instructor to xerox an alternative reading assignment, it must be turned in no later than a week before the presentation date.

You are encouraged to be creative in organizing the class period. For example, such formats as talk shows, games, and role-playing are appropriate. Keep in mind, however, that the number one priority should be serious presentation/discussion of the topic. You are encouraged to make use of handouts, overhead transparencies, etc. If you would like the instructor to xerox material for distribution during the class presentation, it must be turned in no later than forty-eight hours before your presentation.

Each group is required to submit to the instructor a bibliography of sources consulted in preparing the presentation. Other supporting material (outlines, notes, etc.) may also be turned in.

Progress Reports

The instructor will meet twice with your group to discuss progress on the presentation. The first progress report meeting will take place two to three weeks before the presentation. This meeting will consist of a discussion of the topic, progress to date on research, and a general outline of the class presentation, including division of responsibilities among the group members. The second meeting will be scheduled to occur

two to five days before the class presentation. By the time this meeting takes place, the bulk of your research should be completed and you should be finalizing the details of the presentation itself. All group members are required to attend the progress meetings.

Grading

The group project constitutes twenty percent of the overall course grade. The grade for the project will be based upon three sources: an evaluation by each group member of the contribution to the project of the other members in the group, an evaluation of the presentation by the rest of the class, and an evaluation of the project by the instructor.

Topics

Whistle-blowers (February 28). Two engineers employed by Morton Thiokol, the company that built the *Challenger*'s ill-fated solid rocket boosters, were labeled "whistle-blowers" for telling the presidential commission that investigated the accident about the events that preceded the accident. Others have blown the whistle on high-risk technologies such as nuclear power. More often than not, such individuals pay a heavy personal price for their actions. Are whistle-blowers good for society? Can and should anything be done to protect them?

Cross-Cultural Risk Distribution (March 14). As the Chernobyl accident demonstrates, the impacts of technological catastrophes are not always constrained by political or cultural boundaries. While some of the distant fallout from Chernobyl was visited upon people that rely on nuclear energy as a power source, others, such as the Lapps of northern Scandinavia, were significantly affected despite the fact that they receive no benefits from nuclear power and most other industrial technologies. Is it just to expose people to risks from technologies from which they stand to gain no benefits? How can people be compensated for the loss of their way of life?

Exporting Risk (April 11). Unlike Chernobyl, the health and safety impacts of the Bhopal catastrophe were limited to the general vicinity of the plant. The plant's principal owner, however, was a multi-national corporation with headquarters in the United States, a country with much stricter environmental and safety regulations than most developing countries. Is it ethical for corporations to "export" risk in this manner? Is it morally acceptable for the government of the country in which the corporation is based to permit it?

Corporate Ethics and Risky Technology (April 25). The Exxon Valdez oil spill accident has contributed to renewed calls for greater ethical and social responsibility on the part of corporations, particularly with respect to environmental issues. Is there any evidence that such calls are being heeded? Can corporations ever be expected to respond to anything other than "the bottom line?"

Are Catastrophes Inevitable? (May 2). Charles Perrow has argued: "No one wants disasters, and better designs, safety measures and regulations can help reduce their likelihood. But as long as national goals are served by risky systems, we will continue to have them and their catastrophes." Are we bound to have catastrophes if we continue to rely upon the technological systems considered in this course? Can and should we do without such risky systems?

COURSE SYLLABUS
HISTORY OF TECHNOLOGY

History 215
Fall 1990

Donald C. Jackson
Department of History

Course Description:

This course is an introduction to the history of technology from ancient through modern times. More than just a historical survey of "hardware" or famous inventions, it strives to explore the important role played by cultural influences in determining the nature, extent, and direction of technological development. In this context elements of human society are not seen merely as benefactors (or victims) of technology, but as determinants of its development and use. Simply put, the course is designed to underscore the complexity of technology's relationship to, and effect upon, society. Subjects addressed by the course cannot cover all aspects of our technological heritage, but the syllabus attempts to provide a broad temporal and thematic overview which raises issues relevant to many other historical topics.

Course Requirements:

It is expected that students will keep current with reading assignments and attend classes on a regular basis. Emphasis is to be placed upon CLASS INVOLVEMENT, and 20% of the course grade will be dependent upon how much energy the student puts into such things as coming to class, keeping current with assignments, asking questions, answering questions, participating in discussion, and generally paying attention to class activities. This course is not a "TV show" where you can show up most of the time, watch what is going on, skim the readings, take the exams, crank out a couple of papers, and then expect to get an exemplary grade on your transcript. But if you show interest and take things seriously, then you should not need to worry about your GPA. Along with class involvement (20%), the course grade will be based upon a midterm exam (20%), a final exam (25%), a term paper on a subject of the student's choice (25%), and short written papers assigned during the term (10%).

Course Readings:

David Billington, *The Tower and the Bridge* (New York, N.Y.: Basic Books, 1983).

Donald Jackson, *Great American Bridges and Dams* (Washington, D.C.: Preservation Press, 1988).

Donald MacKenzie and Judy Wacjman, *The Social Shaping of Technology* (Milton Keynes, England: Open University Press, 1987).

Randall Stross, *Technology and Society in Twentieth Century America* (Chicago, Ill.: Dorsey Press, 1989).

David A. Hounshell, "The Ford Motor Company and the Rise of Mass Production" in *From the American System to Mass Production, 1800-1933* (Baltimore, Md.: Johns Hopkins Univ. Press, 1984).

David Hounshell, "Elisha Gray and the Telephone: On the Disadvantages of Being an Expert," *Technology and Culture* 16 (April 1975): 133-61.

Lewis Mumford, "The First Megamachine," "Technics and Human Civilization," and "The Reinvention of the Megamachine" in Donald Miller, editor, *The Lewis Mumford Reader* (New York, N.Y.: Pantheon, 1988).

"From Small Beginnings" in Werhner Van Braun, Kenneth Gatland, Harry Rose, and A. V. Cleaver, *Project Satellite* (London, Engl.: British Book Centre, 1958).

Lynn White, "The Act of Invention," *Technology and Culture* 3 (1962): 486-500.

Peter Drucker, "The First Technological Revolution & Its Lessons," *Technology and Culture* 7 (1966): 143-51.

Eugene Ferguson, "The Mind's Eye: Nonverbal Thought in Technology," *Science* 197 (Aug. 26, 1977): 827-36.

Thomas P. Hughes, "ENIAC: Invention of a Computer," *Technikgeschichte* 41 (1975): 148-65.

Richard Hewlett, "The Beginnings of the Development in Nuclear Technology," *Technology and Culture* 17 (July 1976): 465-78.

Walter Prescott Webb, "The Spread and Use of the Horse Among the Plains Indians" in *The Great Plains* (Lexington, Mass.: Ginn & Co., 1931).

Assignments:

Week 1 (Aug. 28-30): **Introduction: What is Technology?**
READINGS: White, "The Act of Invention"; MacKenzie & Wajcman, "Do Artifacts have Politics?"

Week 2 (Sept. 4-6): **Technology versus (?) Science**
READINGS: Ferguson, "Nonverbal Thought in Technology"; Mumford, "Technics and Human Civilization"; Billington, Chaps. 1 and 12; MacKenzie and Wajcman, "How the Refrigerator Got Its Hum"

Week 3 (September 11-13): **"Ancient" Technologies**
READINGS: Drucker, "First Technological Revolution"; Mumford, "The First Megamachine"; and Webb, "Spread and Use of the Horse."

LIBRARY RESEARCH "MINI-PAPER" DUE SEPTEMBER 13.

Week 4 (September 18-20): **Machines, Labor and Factories**
READINGS: MacKenzie and Wajcman: "Watermill and Feudal Authority," "The Machine and The Worker," "Technology and Capitalist Control," "The Self-Acting Mule and Social Relations in the Workplace," "Social Choice in Machine Tool Design." Stross, Chap. 3, "Scientific Management"; and Hounshell, "Ford Motor Company."

Week 5 (September 25-27): **Electricity, Power and Corporate Invention**
READINGS: MacKenzie and Wajcman, "Edison and Electric Light"; Hounshell, "Elisha Gray and the Telephone"; and Stross, "Corporation as Inventor," Chap. 4.

Week 6 (October 2-4): **Women and Technology**
READINGS: Stross, "More Work for Mother," Chap. 13; "Birth Control in America," Chap. 6. MacKenzie & Wajcman: "Caught in the Wheels...," "The Material of Male Power," and "Industrial Revolution in the Home."

Week 7 (October 11): Review and MIDTERM EXAM: October 16.

Week 8 (October 16-18): **Dams and Water Supply**
READINGS: Jackson, "Bridges: Spanning the Nation," "Saving Historic Bridges and Dams." Bridge entries for "New England," "Mid-Atlantic," "Midwest," and "West."

Week 10 (October 30 - November 1): **Structures as Art**
READINGS: Billington, Chaps. 2-6, 8 and 9.

Week 11 (November 6-8): Term Paper Proposals: Oral Presentations
Written Critique: Can Structural Technology Be Art? Due November 6.

Week 12 (November 13-15): **The Military and Modern Technology (General)**
READINGS: MacKenzie & Wajcman: "DeGribeauval and the Origins of Planned Invention for War," and "The American Army and the M-16 Rifle"

Week 13 (November 20): **The Military and Modern Technology (Aeronautics)**
READINGS: Stross, "The Heavens and the Earth." Von Braun, "From Small Beginnings..."

Week 14 (November 27-29): **The Military and Modern Technology (Computers & Nuclear Power)**
READINGS: Hughes, "ENIAC: Invention of a Computer." Mumford, "Reinvention of the Megamachine." Hewlett, "Beginnings of Development in Nuclear Technology." Stross, Chap. 11, "By The Bomb's Early Light."

Term Paper Due November 30.

Week 15 (December 4-6): **The Automobile and the 20th Century.** Final Course Review
READINGS: Stross, Chap. 8, "The Car Culture."

COURSE SYLLABUS

COMPUTERS AND SOCIETY

CS 200
Spring 1990

Carolynn Van Dyke
Dept. of Computer Science

> "The central event of the 20th century is the overthrow of matter. ...today, the ascendant nations and corporations are masters not of land and material resources but of ideas and technology." --George Gilder, *Miscrocosm: The Quantum Revolution in Economics and Technology* (New York, N.Y.: Simon and Schuster, 1989).

Scope and Objectives of the Course:

1. The focus of **CS 200** is not on computers *per se*, but on the radical changes that automatic information-processing seems to be making in many human activities--from financial analysis to professional athletics to theology.

2. **CS 200** is not a course in computer literacy. It is intended for students who already understand the nature and function of computers and who are therefore in a good position to analyze and guide the computer-propelled "revolution."

3. **CS 200** aims to develop not just an understanding of the "information revolution," but also the skills required to participate responsibly in it. At the end of the course, I hope you will have increased your ability to acquire, categorize, analyze, and judge information.

Requirements:

1. Informed participation in class discussion. In preparation for the discussions, reading assignments must be completed on time and in a focused, critical way. I will provide study questions for most of the readings. Weight: 10%.

2. Two tests (3/2 and 4/9) and a final exam. These will be based on readings and class discussion. Weight: 15% for each test. 20% for the final.

3. Occasional short writing exercises (some in-class and some out-of-class) on specific topics. Weight: 12%.

4. A research project (due 4/27) designed to answer a particular question about the impact of computers. Sample questions will be provided in class. The research should involve both primary sources (a visit to a local business, a survey, an investigation, etc.) and secondary sources (library research). In most cases you will submit (a) an annotated bibliography of relevant sources, (b) a table or chart of data, and (c) a 6- to 8-page essay. Topics are due March 9, and a preliminary list of sources is due March 26. Weight: 20%.

5. A final paper (3 to 5 pages) on the long-range prospects for automated intelligence. This may take either of two forms: (a) an essay giving your informed judgment about how far artificial intelligence can go, or (b) a fictional "scenario" of the future, in response to the readings by Clarke, Simons, or Vonnegut. Weight: 8%.

Texts:

Forester, Tom, ed. *Computers in the Human Context: Information Technology, Productivity, and People.* (Cambridge, Mass.: MIT Press, 1989).

Vonnegut, Kurt, Jr. *Player Piano*. 1952. Reprint. (New York, N.Y.: Delta, 1986).

Weizenbaum, Joseph. *Computer Power and Human Reason: From Judgment to Calculation.* (New York, N.Y.: W. H. Freeman, 1976).

Course Outline:

I. Introduction: the "Information Revolution."

1/31 Submit 3 examples of interesting recent applications of computers. These may be from your own experience or from the library (I suggest using Infotrac). Submit either a brief description or a printout of an Infotrac entry. Include the source for each example.

2/2 Pp. 1-3 from "Editor's Introduction," in *Computers in the Human Context*. (Hereafter noted as CHC).

2/5 Kranzberg, "The Information Age," CHC, pp. 19-32.

2/7 Beninger, "The Evolution of Control," CHC, pp. 48-67.

II. Economic and Political Issues.

Maintaining national power.

2/9 Feigenbaum and McCorduck, "The Fifth Generation: Japan's Computer Challenge to the World," handout [reprinted by permission of Addison-Wesley Publishing, from *Creative Computing* (August 1984): 103-11].

2/12 Cohen and Zysman, "Manufacturing Matters," CHC, pp. 97-103. Quinn, Baruch, and Paquette, "Technology in Services," CHC, pp. 104-18.

2/14 Schware and Choudhury, "The Role of IT in Third World Development," CHC, 502-8. Botelho, "Brazil's Independent Computer Strategy," CHC, pp. 509-17.

2/16 Halal, "The New Capitalism," CHC, pp. 433-36 only. Larry Martz, "Revolution by Information," handout [reproduced by permission of Newsweek, Inc., from *Newsweek* (June 19, 1989): 28-29.

2/19 Arterton, "Teledemocracy Revisited," CHC, pp. 438-50.

2/21 Barnaby, "How the Next War Will Be Fought," CHC, pp. 518-26.

Maintaining corporate productivity.

2/23 Harris, et al., "Office Automation: Making It Pay Off," CHC, pp. 367-76.

2/26 Bowen, "The Puny Payoff from Office Computers," CHC, pp. 267-71.
Franke, "Technological Revolution and Productivity Decline," CHC, pp. 281-90.

2/28 Warner, "Information Technology as a Competitive Burden," CHC, pp. 272-80.

3/2 Test.

Maintaining individual productivity.

3/5 Shaiken, "The Automated Factory: Vision and Reality," CHC, pp. 291-300. Bessant and Chisholm, "Human Factors in Computer-Integrated Manufacturing," CHC, pp. 308-17.

3/7 Kling and Iacono, "Desktop Computerization and the Organization of Work," CHC, pp. 335-36, 349-52. Smith, "Information Technology in Banks: Taylorization or Human-Centered Systems?" CHC, pp. 377-90.

3/9 Short paper: do computers improve your productivity? Submit topic for research project.

III. Social Issues

The electronic community.

3/19 Forester, "The Myth of the Electronic Cottage," CHC, pp. 213-27. John Markoff, "Here Comes the Fiber-Optic Home," handout [reproduced by permission of New York Times Co., from *New York Times* (November 5, 1989)].

3/21 DeLacy, "The Sexy Computer," CHC, pp. 228-36. Report on your use of on-line information services.

Computers and education.

3/23 Writing exercise, using Edward B. Fiske, "Reform by High-Tech," handout [reproduced by permission of New York Times Co., from *New York Times* (January 7, 1990)]; Bass, "Computers in the Classroom," CHC, pp. 237-47; and Ely and Plomp, "The Promises of Educational Technology," CHC, pp. 252-61. (Fuller explanation on reading guide.)

Computers and equality.

3/26 Gerver, "Computers and Gender," CHC, pp. 481-501. Submit working bibliography for research project.

3/28 Foster, "The VDT Debate," CHC, pp. 188-97.

IV. Legal and Ethical Issues.

Computers and privacy.

3/30 Marx and Sherizen, "Monitoring on the Job," CHC, pp. 397-406. "Is Nothing Private?", handout [reproduced by permission of McGraw-Hill, Inc., from *Business Week* (September 4, 1989): 74-82].

Computer crime.

4/2 Hearnden, "Computer Criminals Are Human Too," CHC, pp. 415-26.

Proprietary rights.

4/4 Branscomb, "Who Owns Creativity?" CHC, pp. 407-14. Brian Kahin, "The Impact of Software Patents," handout [reproduced by permission of Educom, from *Educom Review* 24 (No. 4): 26-31].

Professional ethics.

4/6 Code of Professional Conduct of the Association for Computing Machinery, reprinted in Richard S. Rosenberg, *Computers and the Information Society* (New York, N.Y.: Wiley, 1986), Appendix A.

4/9 Test.

V. Intelligent Machines and the Future of Humanity.

4/11 Weizenbaum, *Computer Power and Human Reason*, Introduction.

4/13 Weizenbaum, Chapter 4.

4/16 Film on applications of AI (shown in class).

4/18 Dreyfus and Dreyfus, "Why Computers May Never Think Like People," CHC, pp. 125-43.

4/20 Sheil, "Thinking About Artificial Intelligence," CHC, pp. 157-65. George Johnson, "Casting Their Neural Nets," handout [reproduced by permission of New York Times Co., from *New York Times Book Review* (December 24, 1989): 12-13].

4/23 Weizenbaum, Chapter 8.

4/25 Weizenbaum, Chapter 10.

4/27 Research project due.

4/30 Arthur C. Clarke, "The Obsolescence of Man," handout [reproduced by permission from *The World of the Computer,* ed. John Diebold (New York, N.Y.: Random House, 1973), pp. 396-410].

5/2 Vonnegut, *Player Piano*, Chapters 1 through 8.

5/4 Vonnegut, Chapters 9 through 17.

5/7 Vonnegut, Chapters 18 through 25.

5/9 Finish Vonnegut.

5/11 Final Paper Due.

COURSE SYLLABUS

THE ENGINEERING METHOD

INDS 365
Spring 1990

Roger W. Ruggles
Department of Civil Engineering

Course Description:

An introductory course for non-engineering students which describes the engineering design process and the constraints under which it operates. Illustrations of economic, risk, ethical, and legal considerations and their effects upon engineering designs are presented, leading to an appreciation of the many non-technical elements involved in technical decisions and the avenues by which such decisions can be influenced by the public.

Expectations of Students:

Upon completion of the course, the student should understand that there are multiple methods used in engineering design. Constraints such as safety, legal aspects, risk, and economic concerns can alter the method of engineering design. Through an actual design project, the student is exposed to these constraints and obtains experience in choosing between them. Students are required to make an oral presentation of the design project at the end of the semester.

References:

1. "Report of the Committee on the Case of the Failure of the South Fork Dam," *Transactions*, American Society of Civil Engineers, 24 (June 1891).

2. George A. Kiersch, "Vaiont Reservoir Disaster," *Civil Engineering* (March 1964).

3. Joseph T. Bockrath, *Environmental Law for Engineers, Scientists, and Managers*. (Hightstown, N.J.: McGraw Hill, 1977).

Course Syllabus:

Day	Subject
1	Introduction: What does an engineer do? How is an engineer educated? What is a Licensed Professional Engineer?
2	Failures in engineering: The Johnstown flood, 1889 (Reference 1)
3	Failures in engineering: Vaiont Reservoir disaster, 1963 (Reference 2)
4	Engineering and the law: National Environmental Policy Act (NEPA) (Reference 3)
5	Engineering and the law (case study): National Resources Defense Council v. Morton (Reference 3
6	Engineering and the law (case study): Calvert Cliffs Coordinating Committee, Inc. v. Atomic Energy Commission (Reference 3)
7	The 1972 Federal Water Pollution Control Act The Clean Air Act (Reference 3)
8	Ethics in engineering
9	Review

10 Start of design exercise: Introduction of project and requirements; Distribution of materials; Discussion of project--Why? Risks. Benefits. Liabilities.

11 The topographic map: What does it mean? How is it made? How is it used in the engineering design process?

12 Location of the dam and determination of the reservoir volume.

13 What is hydrology and how is it used in engineering design?

14 Computer use in engineering: Development of a hydrograph; Use of the graphics program GRAFKIT

15 Computer use in engineering: Development of a flow duration curve; Use of the graphics program GRAFKIT

16 Review

17 Dam design: Different types of dams and their advantages and disadvantages

18 Determination of the volume of the dam

19 Field trip: Merrill Creek Dam; Chain Dam

20 Determination of the material required and the cost for dam construction.

21 Development of turbine discharge

22 Determination of penstock route

23 Design of the penstock

24 Demonstration of waterhammer

25 Engineering economics

26 Engineering economics

27 Engineering economics

28 Optimization

29 Risk assessment

30 Applying economic analysis to penstock design

31 Review

32 Turbines used in hydroelectric power production

33 Construction of the power house

34 Other important features of the project

35 The planning process

36 Critical flow method

37 Project management

38 Report preparation: Importance of writing informative engineering reports

39 Report preparation: Organization of reports; Who is your audience?

40 Report preparation: Oral reports on project

41 Overview of engineering: Review of different fields of engineering; Examples of different types of work in each field of engineering

42 Review

SEVENTH ANNUAL TECHNOLOGICAL LITERACY CONFERENCE

February 6-9, 1992

Radisson Mark Plaza Hotel, Alexandria, VA

CALL FOR PARTICIPATION

The Planning Committee for the Technological Literacy Conference invites you to submit a proposal to participate in the Seventh Annual Technological Literacy Conference, the national gathering of the STS community. The committee will consider proposals for the following types of presentations:

Hands-on workshops and activities (1 hour)
Papers, tutorials, or case studies (20 minutes)
Roundtable or panel discussions (1 hour)
Posters (on display 2 hours)

Conference Themes

We will again hold special lectures and presentations organized around the following themes:

Education and Information
Environment
Health and Biomedicine
Moral, Ethical and Philosophical Perspectives
Technology, Industry and Work

TLC-7 REGISTRATION FEES

For new or renewing NASTS members (memberships expire 1/1/92):

Membership renewal for 1 year (includes newsletter)	$40
Early TLC registration (by Dec. 1)	$80
Registration after Dec. 1	$95
Weekend (Sat/Sun) registration	$60
Student registration (includes membership)	$40

For non-members:

Early TLC registration (by Dec. 1)	$130
Registration after Dec. 1	$145
Weekend (Sat/Sun) registration	$110

Audio/Visual Equipment Rental Fees: Due to the increasing demand for A/V equipment, we need to ask users to pay a small portion of the equipment rental costs: Slide projector, $15. Overhead projector, $15. VCR and monitor, $25. Flip chart, $5.

About the Radisson Mark Plaza Hotel:

This year we will hold TLC-7 at the Radisson Mark Plaza Hotel, located in Alexandria, Virginia, just to the southwest of Washington, D.C. Our conference site committee and staff were very impressed by its relaxed atmosphere, easy-to-understand layout, diversity of eating facilities, and recreational amenities (indoor pool, racquetball/handball courts, and exercise equipment). The hotel is located adjacent to an 80-acre nature park with a lake and jogging trails. The hotel provides complimentary shuttle services to the National Airport and Metrorail Station. Room rates will be $95 per night (single or double) plus tax.

CONFERENCE FEATURES

Plenary Speakers: experts and leaders in the STS community (Thursday pm; Friday am; Saturday am & pm; Sunday am).

Invited Theme Programs: special presentations by noted individuals in the areas of Education & Information; Environment; Health and Biomedicine; Moral, Ethical and Philosophical Perspectives; and Technology, Industry and Work.

Community Breakout Sessions: discussion groups, organized by professional "communities," held immediately after morning plenary sessions.

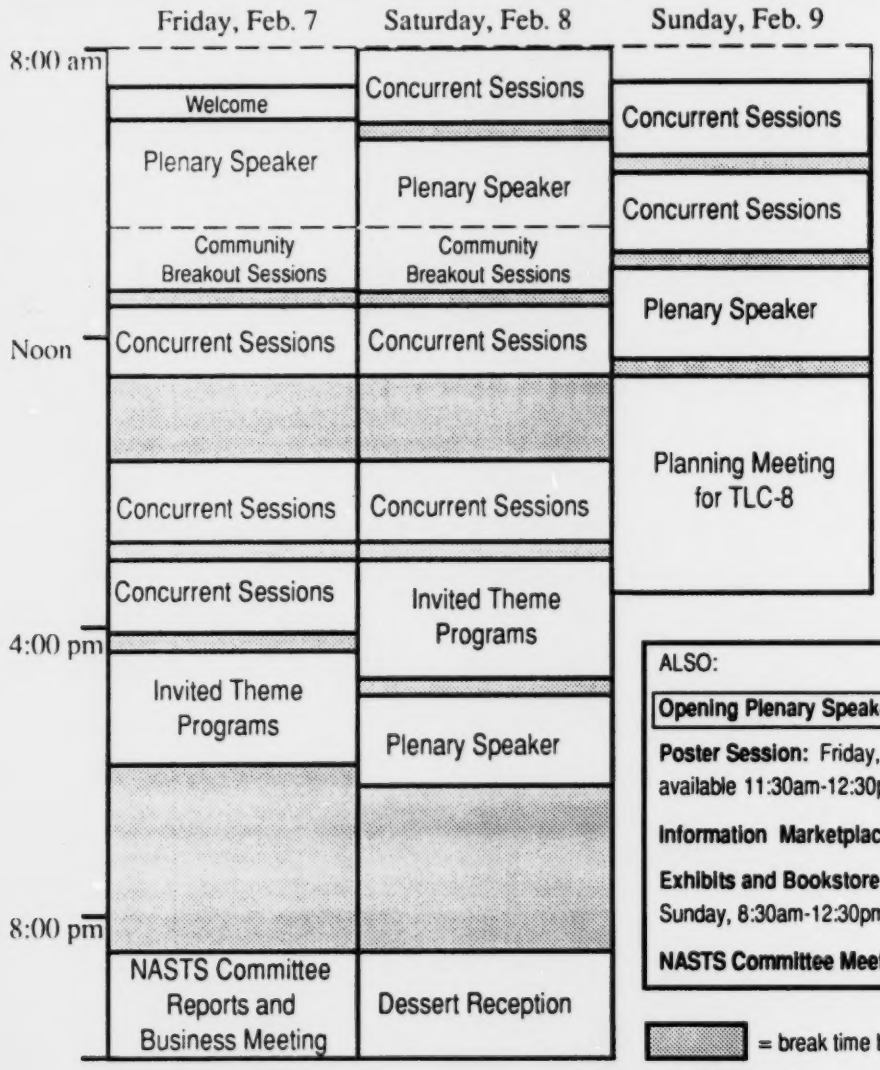
Concurrent Sessions: papers, tutorials, case study reports, workshops, roundtable discussions, and posters presented by conference participants.

Information Marketplace: a two-hour event early Friday afternoon featuring representatives and materials from educational institutions, governmental agencies, and non-profit organizations.

Exhibits and Bookstore: publishers, vendors of educational materials, and non-profit groups on exhibit throughout the conference.

Dessert Reception: coffee, tea, and desserts and a convivial atmosphere for mingling with friends and making new acquaintances! (Saturday evening)

NASTS Business Meeting & Committee Meetings: an opportunity to become involved in various NASTS programs and projects. (Committee Reports & Business Meeting, Friday evening; Committee Meetings, Saturday lunch)



Seventh Annual

TECHNOLOGICAL LITERACY CONFERENCE

February 6-9, 1992
Radisson Mark Plaza Hotel
Alexandria, VA

ALSO:

Opening Plenary Speaker: Thursday, 7:30-9:30 pm.

Poster Session: Friday, on display 11:30am-1:30pm (presenters available 11:30am-12:30pm).

Information Marketplace: Friday, 11:30am-1:30pm.

Exhibits and Bookstore: Friday & Saturday, 8:30am-5:30pm and Sunday, 8:30am-12:30pm.

NASTS Committee Meetings: Saturday, 12:30-1:30pm (working lunch).

= break time between sessions or for meals.

Technological Literacy Conference (TLC-7) Proposal Form

Title of Presentation: _____

	Presentor	(Co-Presentor)	(Co- Presentor)
Name:			
Institution:			
Address:			
Phone:			

Please note any special circumstances that would affect the scheduling of your presentation. We will try to accomodate your requirements to the best of our ability:

Preferred format: ❒ Paper, Tutorial, or Case Study (20 minutes) ❒ Poster (on display 2 hrs; presentor available 1 hr.)
❒ Panel or roundtable discussion (1 hour) *Moderator:* _____ ❒ Hands-on workshop (1 hr.)

Equipment needs: ❒ overhead projector (fee: $15) ❒ 2" x 2" carousel slide projector (fee: $15)
(and rental fees) ❒ standard-size VCR (VHS) and monitor (fee: $25) ❒ flip-chart (fee: $5)

Notes: Please return your completed proposal form by **October 1, 1991** to: Conference Manager, NASTS, 133 Willard Building, University Park, PA 16802. (Tel.: 814-865-9951; FAX: 814-865-3047.) Proposals will be evaluated by the Proposal Review Committee, a peer-review panel. If the proposal is accepted, all presentors listed above must register for the conference and pay appropriate registration fees by December 1, 1991 to be included in the program. **Due to the increasing demand for audio-visual equipment at the TLC, we need to ask users to pay a small portion of the equipment rental costs.** This amount will be collected with the registration fees.

Abstract of Presentation. Please write a description (250 words maximum) of your presentation. Include a statement of the steps you will take to involve the participation of attendees. (All presentations must leave time for audience participation. Posters will be on display Friday, 11:30 am-1:30 pm; presenters will need to be available for questions 11:30 am-12:30 pm.)

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1 2 3 4 5 6 7 8 9 10

RETURN PROPOSAL FORM TO: NASTS, 133 Willard Bldg., University Park, PA 16802

TECHNOLOGY STUDIES AT LAFAYETTE COLLEGE
A SPECIAL THEME ISSUE

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Science, Technology & Society is a newsletter devoted to the general area of science, technology, and society studies. It is a joint project of the Lehigh University STS Program and the Technology Studies Resource Center and publishes short articles on the theoretical and speculative aspects of curriculum development, in-depth program and course descriptions, reviews of texts and audio-visual aids, and an annotated bibliography of current books and articles. An "Open Forum" section exists for readers with questions, comments or announcements regarding STS activities or needs. Our goal is to help generate new courses, and provide an information exchange, in the STS field.

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Science, Technology & Society

Curriculum Newsletter of the Lehigh University STS Program & Technology Studies Resource Center

Editor
Stephen H. Cutcliffe

No. 84, June 1991
ISSN: 0275-8075

THE BATTLE OF THE BOOKS:

THE CANON IN THE AGE OF A NEW TECHNOLOGY

In an oft-quoted passage in *The Closing of the American Mind* (1987), Allan Bloom mused on the tattered culture that surrounded him. In the 1960s, he found he was in the minority. He voted, often with a sense of futility but always with a sense of rage, against changes to a core curriculum. He recognized that the curriculum with its Chinese list of requirements--something from column A and something from column B--taught his students little and bored them to boot. But vote against change he did. Keeping the core requirements--empty and hollow though they might be--seemed to have a value. They were, he decided, "a threadbare reminiscence of the unity of knowledge and provided an obstinate little hint that there are some things one must know about if one is to be educated..." (p. 320).

Teaching even a threadbare version of what we should know, says Bloom, is better than teaching nothing. And if the center will not hold? If the old unities cannot explain the present? One teaches as though the old order still applied.

The idea that there is a unity to knowledge is what discussion of The Canon is about. At this point near the end of the twentieth century, what must we know, if we are to be considered educated and civilized? And what must we read to become that way? The questions are not new. They have been around awhile. Each generation seems compelled to ask them. Sometimes they are asked with revolutionary results, as Martin Luther's generation discovered. Sometimes they are presented with introspective calm, as did Henry Adams when he described his days reading Kant and the Transcendentalists at Harvard College, just a few years before the Civil War began.

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These questions, like all questions of faith, belief, and value, come at a moment of change--when the old values do not apply and the old community no longer easily fits together. The debate, such as this one about The Canon, is thus a symptom of a problem. It is not the problem itself.

Let us be honest. Questions on truth and knowledge are easy to ask. The right question is hard to find. In this case, the question is not "what must we know?"--as though there is a body of knowledge external to us--but rather, the question should be "Where are we?" "Where do we live?" "What is the terrain that surrounds us?" This is a question of context.

Others have discussed the changing social and political context that makes us question the old curriculum and our requirements. The social terrain has certainly changed a great deal since the nineteenth century when Walter Raleigh and Matthew Arnold considered what gentlemen could be expected to know. I describe a changed context of a different kind: the changing environment wrought by a new technology--one of electronic media and computers--that makes a debate on The Canon inevitable and the ability to string together a canon, more problematic.

The technological landscape has quite dramatically changed since most of us were students. In fact, it has changed so quickly that we may be excused if we slept through the night while it happened. Few of us now can work without our computers and word-processing programs. Most of us routinely use the computing systems of libraries to do our research. Many of us correspond through fax machines in the way we once used the postal service in days of yore. Some of us log on to computer networks to get an answer to a difficult or exotic question or to converse with colleagues anywhere in the world.

And what we have seen on the landscape is only a prelude to what will come--in fact, is here. We can integrate images, sounds, and texts from a variety of sources and "desktop" publish the results. We can re-make photographs, adding new faces to the family portrait or new figures to the historical document. We can videotape at will, edit as needed, and alter "reality" to make a point--or change one. And so it goes.

What does this mean to us in the daily press of our professional and intellectual lives? We all know that we are now part of a global society. There are fewer and fewer, small and isolated communities in which its members speak and work together to develop what passes for a social or economic agenda. Every message is written for a possibly larger audience. Almost any idea may be translated through the mass media to communities throughout the world. We overhear and see everything.

The effects of this or any technology on culture have been told often enough. They do not have to be repeated at length now. But to be clear about the state of The Canon, we must understand a few:

1. Major technological revolutions place great stress on values, traditions, and assumptions.

Sometimes, a new technology reconfirms old values, highlights them,

romanticizes them. Take, for example, the nineteenth-century Romantic tradition. Writers of the time imagined that a call for a "Return to Nature" could overturn the industrial revolution and the alienation from work, family, and community. The Romantics had their Canon. As Henry Adams remarked, "Goethe was raised to the rank of Shakespeare--Kant ranked as a law-giver about Plato." A controversial agenda? Perhaps. Certainly an ideological one.

Sometimes, a new technology redefines, reshapes, and even distorts the old values. The technology of what we call the Renaissance--printing, optics, and the beginnings of mass-production--reshaped the structure of society and the structure of human relationships. It is not too much to say that as a result of the technology people began to think differently.

For the first time, a scholar could sit alone in one room with a multitude of texts to consider, to compare and contrast. More was available to him in one moment than had been available in a lifetime of travel to those living in the scribal culture. The experience created a new private space in which the writer could consider himself by considering the reflection of others. It established the personal voice and the full voiced ego we now associate with authors--the ego that owns and controls what is thought.

The Renaissance established a new book list, written by writers like Erasmus, Machiavelli, More, and Montaigne (to name a few). They rejected the immediate past, turned away from the Scholastics and their reliance on Aristotle and chose to read Cicero and Seneca and, by reading them, rediscovered Plato. This book list we now call "The New Humanism," in which Man is found to be at the center of things.

Finally, a new technology becomes the value, embraced because of what it can do, and thus, becomes the metaphor used to describe the world. This may be said to be the state of things in the early twentieth century. Then the mechanical revolution provided the images of progress, change, life, and death that defined the era. Consider on one side Picasso's "Guernica," Duchamp's "Nude Descending the Staircase," and Cubism; on the other, Chaplin's movie *Modern Times*.

2. The existence of a new technology seems always to fragment the sense of community before it creates a new one.

We see this most clearly now, in the age of electronic media. Every day, television, radio, and more frequently fax machines and computer bulletin boards provide us with an infinite number of possibilities (and an equal number of choices, messages, and decisions). When there are so many possibilities, so many images, so many alternative versions of the same story, so many stories to read, it is hard to know which to read first. It is even harder to know what we should require of the next generation so that they will share a sense of values, community, and history. Perhaps Santayana was right when he said that it did not make a difference what students read as long as they read the same things. Any book list may do.

3. A new technology changes the way we do business.

The current wave of new technology

will have an especially significant impact on those of us in education, writing, and publishing. It promises to alter what we read, how we read and write, how we get our hands on new "texts," and how we get to the old ones.

To illustrate the point: Hypermedia is a software program that integrates words, images, and sounds. But it goes further. It allows the user (what we used to call the reader) to move through the "text" in a variety of ways--in a straightforward, linear direction or digressively by following the logic of sidebar annotations, footnotes, or illustrative material.

For example, at this point in a paper written in hypermedia on the topic of The Canon in the Age of a New Technology, a reader might now digress to a fuller discussion of hypermedia, see and use examples of hypermedia programs, read an early history of the development of hypermedia, and then return to the text proper. And she could do this without moving from her library--a library that is infinitely larger and more extensive than that which the Renaissance scholar prided himself in having acquired.

A librarian, discussing the potential of hypermedia on the library of the future, observes that, with it,

> users are never forced to go in directions they don't want, nor are they confronted with vast amounts of unstructured information to wade through. ...one can follow along deeper into explanations, branching at several points and either come full circle to the starting text, or jump back to it at any point.
>
> We have traditionally forced individuals into conforming roles. ...in the near future, users will be able to use their own thought patterns, their own associations and views of the world, to retrieve information.

[P. Molholt, in *Library Journal*, Nov. 15, 1988, pp. 38-39.]

Who is in charge here? Clearly the user/reader! "Users," as the librarian says, "are never forced to go in directions they don't want." What has become of the author? We used to think that the author's voice was the result of the progressive effects of argument, logic, and tone. In a hypermedia text, there is now a good argument to be made that the reader shares equal billing. As I say, new technologies change the way we do business--and change what we mean by the business we are doing.

What will such technological wizardry mean for the establishment of a Canon? Texts will become progressively more idiosyncratic. They will incorporate the work of many authors. Each will be organized in a temporary order. New reader/users will be free to reshuffle the parts, according to their needs, interests, and backgrounds.

Such a future promises a number of exciting possibilities. Still, for any of us who grew up and found meaning in fixed, authored books, this future must be troubling. We have become comfortable with the developed point of view an author provides, the values stitched into the progression of the work, and the developed set of relationships between the particular book we are reading and other books we have read. Some conclusions are in order.

1. The New Technology Changes the Role of Authority and the Status of the Conventional Author.

To believe in The Canon is to believe in gatekeepers--whether yours or mine. They are the ones with the authority to decide what is written, taught, and published. The new technology opens all gates. In a time of desktop publishing and computer bulletin boards, the function of the gatekeeper is about to be dramatically redefined. In a time of hypermedia "texts," the author, the reader, and the publisher are nearly one.

We must now ask basic questions. Whose work do we study when it is clearly the product of collaboration? Whose voice do we hear when the work before us is not fixed, and not meant to be? What tradition is evoked when each reader has the power of an author and publisher: the power to add and subtract values (or to add and subtract content) in a way so seamless that one cannot tell where the stitching is? In sum, is the debate about The Canon material? If there is no one to control the tradition, except each reader, can we have a Canon that presents a line of texts linking all readers?

2. The Technology Changes What We Teach.

The Canon and the study of literature change when we integrate word, image, and sound. (And we integrate word, image, and sound, at least in part, because we discover we now can, and with remarkable ease.) The emphasis shifts from content to form, from the text to the context, preparing the stage for the deconstructionist debate.

The Canon debate has centered on the effect on values and tradition by the inclusion of minority literature and political discourse. It has not considered the change caused by the power of the technology to add visual material, to each new and specialized audiences, or to manipulate (re-structure or re-compose) material electronically. These are questions we cannot avoid much longer, if we are to come up with useful answers.

3. The Technology Changes the Way We See What We Understand.

The idea of a Canon assumes a finite universe, bounded by a limited (or selected) number of texts. Technology, like that of hypermedia, produces the illusion (if not the fact) of an infinite, pseudo-Romantic universe--layer upon layer of image, fragment on fragment, no boundaries, no limits. And so farewell, "The Great Books" list and "The Five-Foot Shelf" of Books.

4. The Opening Up of "The Canon" is an On-going Process.

It should be clear that changes to The Canon (questions about the tradition and the ways we express our values) are the result of changes in media, expansions in audience, and the development of new technologies.

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THE PROGRESS OF STS IN SCHOOL SCIENCE:

REFLECTIONS OF NATIONAL LEADERS

Many secondary science teachers in the United States, often working alone at the grass roots level, introduced Science, Technology and Society as a curriculum theme during the 1970s. *The 'Project Synthesis' Report*, (Harms and Yager, 1981); National Science Teachers Association Position Paper, *STS: Science Education for the 1980s* (1982); National Science Board's Report, *Educating Americans for the 21st Century* (1983), and other authoritative reports accelerated the development of STS in the schools. The **Science through Science, Technology and Society Project** was founded at Penn State in 1984 to develop a definition of STS, prototypic materials, and the *National Technological Literacy Conferences (TLC)*. In 1987 the National Science Foundation funded a National STS Network to support teachers in implementing STS.

The 1990 *TLC* presented us with the opportunity to review the progress of the STS movement in the schools. To do so we interviewed eleven national STS education leaders, asking them to reflect on what had already been achieved, what remained to be achieved, how their own thinking about STS had evolved, what they thought STS leaders should be doing now, and what they, themselves, planned to do in the next three years. We sent these questions by mail and followed up (except in two cases, where written responses were very complete) with in-person interviews at the *TLC*, drafts of which were returned to interviewees for further elaboration.

I. WHAT HAS BEEN ACHIEVED AND WHAT REMAINS TO BE DONE?

Individual leaders noted that STS is at the "cutting edge of science education," both in its own right and as an important theme in other science education reforms, such as *ChemCom* and *Project 2061*; that publishers are inquiring how to include STS in textbooks; and that STS education has influenced changes in testing towards performance-based testing.

As a group, our leaders agreed that the movement has succeeded in raising awareness among teachers about both STS issues and STS education. Five years ago, many teachers and curriculum leaders still asked, "What is STS; what does it stand for?" Today, they know that science, technology and society is a curriculum emphasis which concerns itself with technology-related topics: artificial intelligence, workplace automation, acid rain, the ozone layer, recombinant DNA, star wars. Concerns have shifted from "I don't know what STS means" to "I don't have the time to include STS" or "I don't know how to teach STS." No leader doubted this achievement.

As Carolyn Graham, New York State's Science Supervisor noted, "We have reached an awareness of STS. Science teachers know what 'STS' means, but they are not necessarily doing anything with it. But we do get calls from the field every day asking about how to implement STS."

On the other hand, our leaders also agreed that the movement had not succeeded in spreading a single, authoritative definition of STS education, or in institutionalizing STS instruction in the schools. Paul Hurd, Professor Emeritus of Science Education at Stanford University in California, noted, "There is still not a clear description of what is meant by STS." Stephen Cutcliffe, Director of Lehigh University's STS Program, observed that "STS started as a quest, and is still a quest. People are still unsure of just what it is or where it is going." Elizabeth Horsch, a science teacher from Casper, Wyoming, took this same idea further, saying that "STS has had a long infancy. The innovation has not matured as rapidly as I might have expected. Infants are dependent; what they will be when they grow up is still uncertain."

For some, said Rodger Bybee, Associate Director

of Biological Sciences Curriculum Study, STS has provided a vision. But the necessary next step is translating this vision from the abstract into concrete curriculum materials. For this to take place, five steps are required: (1) the vision must be further clarified, and Bybee nominated global problems such as ozone depletion, acid precipitation, and the greenhouse effect as the focus, because of the urgency of these concerns; (2) a curriculum framework must be developed which recognizes the value of both discipline-based science and integrated courses; (3) curriculum materials that better exemplify STS should be developed; (4) the role of technology as integral to STS must be clarified; and (5) there must be a better research base for STS in science education.

There was a clear consensus among leaders that the most important unachieved task was "institutionalizing" STS throughout the system of schools. Graham Orpwood, Director of Science Education at New York University, felt that "the challenge is now institutionalizing STS." What has not been achieved, he says, is a sense of the "right" ways, the "best" approach. Carolyn Graham added that "STS has still not infiltrated science education; it's still an add-on. We still have not determined the appropriate place of STS in science instruction." And Irma Jarcho, science teacher at the New Lincoln School in New York City, and editor of the *Teacher's Clearinghouse on Science and Society Newsletter,* observed, "Progress has been made but STS is still of interest to a small group; most teachers are not adopting the approach because they are still enmeshed in the textbook and required exams."

Leaders were concerned that STS had not yet made significant headway in pre-service or in-service teacher training. Paul Hurd noted that STS would have to communicate more directly to the needs and expectations of the biology, chemistry, and physics teachers. The conceptual structure of STS is too abstract, he noted, so these teachers cannot convert STS concepts as presently articulated into lessons and units for their classes. "Teachers do not understand STS interactions, and they do not see how STS relates to their subjects."

Hurd and Orpwood also spoke of difficulties at the pre-service training level. Orpwood noted that most university science teachers are committed to the organization of science instruction by disciplines in separate departments. As a result, "requiring science teachers to get their STS in college science courses will prove difficult." Hurd extended this line of thinking, saying that despite the integration of science in cutting edge research, future teachers learn their science in discipline-based departmental majors. The few advocates of unified science are being undercut by current reforms in teacher education which strengthen the control of science-discipline departments in pre-service teacher preparation.

II. HOW STS THINKING HAS EVOLVED

When asked to describe how their own thinking about STS education had evolved, more than half of our respondents said that there had been no changes in their conception. David Tucker, a leading STS teacher and teacher trainer in Washington State University, summed up this sentiment. "I am more of a believer now than ever" that STS can assist in achieving science instructional goals, because "all the programs I know are run by teachers who have total ownership and a lot of pride in their programs."

Elizabeth Horsch added that her idea of what STS "should be" has remained the same, but her idea of what it "will be" has changed.. In 1974 she started using science and society case studies and enjoyed this format so much that she thought it could serve as the model for all STS teaching. But she discovered a problem with this idea of models. "For anything to serve as a model, it must be copied. But then it is no longer the same thing. We wanted to think for ourselves and design our own case studies based on local issues." Rodger Bybee concurred in that he has become more convinced of the STS theme and less convinced that it will gain the importance it should have in American education.

Robert Yager, Professor of Science Education, University of Iowa, said that he now saw the power of STS to lie not so much in new curriculum content, such as the study of global STS issues, but in its relation to key critical incidents in education, such as the choice of curriculum models, instructional strategies, and evaluation methods. "To think of STS as a new kind of content seems to me to miss the point of what STS is--or could be."

Steve Cutcliffe and Graham Orpwood noted a shift of concerns, from technology criticism to techno-economic issues. Cutcliffe said his approaches and understanding of the complexities had mirrored these changes. Orpwood added that his focus has shifted from ethics and technology criticism to economic impacts, policy analysis, and the process of innovation in industry.

Meanwhile David Tucker felt he now thought more adequately about the STS issues themselves. He observed that he lives near a natural wetland, and that before using STS approaches in his teaching, he did not have a clear idea of what he could do to help preserve it. "Now I have a much better idea about what an individual can do and how to do it."

III. NEXT STEPS FOR STS LEADERS

When asked to select the most important next steps for STS leaders to take, our respondents named three kinds of actions: improved communication, both among members of the STS community and between STS leaders and other decision leaders; implementation measures, such as the development of textbook materials, test items and in-service training programs; and fund-raising from public and private sources to support implementation.

Steve Cutcliffe called for putting better communications systems in place: "There are too many activities going on that are not well known." David Phoebus felt that better networking, computer, and FAX links were needed between university-level science education and school science teachers. Paul Hurd expressed the need for working groups from the professional associations to spell out concepts and topics for science courses, while Robert Yager invited leaders to become more vocal in promoting a broad definition for STS and more active in school level STS sessions at *TLC*, in preparing reports on STS for the National Science Teachers Association (NSTA) and National Association for Research on Science Teaching (NARST).

Our leaders felt that many kinds of steps were useful for institutionalizing STS in the schools, including working at the state education policy level to establish mandates and guidelines, working with other groups in the larger educational reform movement, preparing text materials for instruction, developing test items for standardized achievement tests, and providing in-depth teacher preparation programs for both pre-service and in-service teachers.

IV. CURRENT ACTIVITIES AND PLANS FOR THE FUTURE

Our leaders planned to continue activities of the sort that have established their leadership in the STS education community. Scholars like Steve Cutcliffe, Rodger Bybee, and Paul Hurd will continue to write about STS and education. Cutcliffe will be serving as President of the National Association for Science, Technology and Society. Bybee will develop a conceptual framework for teaching about the history and nature of science and technology with NSF support and will be disseminating Biological Sciences Curriculum Study developed educational packets on global change for National Science and Technology Week. He is developing a new high school biology program oriented to human ecology. Hurd will continue to examine the philosophical bases for biology education and new theory of learning implicit in current scientific knowledge, and continue work on the biology curriculum as it shifts to a human emphasis.

Teacher educators in science, Robert Yager and Graham Orpwood, will continue to provide STS in-service workshops. Orpwood is following up his thinking about STS and economic development with a master's degree level course, and he is offering a course in London this year to introduce United States science teachers to new STS innovations in the United Kingdom. Yager is serving as Vice President for NASTS and will chair the *Seventh Annual Technological Literacy Conference*. He is also completing a new National Science Teachers Association monograph and work on a new book on "What Research Says" about the benefits of STS. In addition to assessment efforts, Yager plans to continue to involve successful teachers of STS at a variety of national meetings.

Teacher leaders plan to direct their STS expertise beyond the school district level. Elizabeth Horsch is now chairing a statewide consortium for science education reform in Wyoming, with an eye toward establishing a strong STS component and defining

specific criteria for technology literacy. Jon Harkness is working on the incorporation of STS in performance-based testing, while Irma Jarcho will continue to devote most of her STS time to the dissemination of STS information, values, and concerns to teachers through the newsletter of the Teacher's Clearinghouse for Science and Society Education.

David Tucker and David Phoebus plan to assist classroom implementation of STS. Tucker will conduct teacher workshops on topics related to STS instructional strategies, as well as publish articles. Phoebus, together with his teaching colleague, George McCeney, will continue to develop their model team-taught course, give presentations at state and national meetings, and conduct workshops. They also plan to work with state, county, and university leaders to establish a stronger pre-service "connection" in STS.

Carolyn Graham, the only state department science supervisor among our interviewees, will develop connections in New York State between educators in science education, technology education, and social studies. A new science syllabus is being developed with a STS component and instructional approach. Integrated supplemental science units on solid waste, land use, and health are being developed for grades seven through nine with joint funding from the National Science Foundation and New York Power Company.

SUMMARY

The leaders we spoke with agreed that the STS movement is at the cutting edge of science education reform and has succeeded in raising STS awareness among educators. But the movement has to this point failed to disseminate an authoritative definition or vision, a curriculum framework, or validated curriculum materials. It has failed to effect a deep change in the perceptions of the nation's science teachers about the goals of science instruction and to bring about large-scale pre-service or in-service teacher training programs or the broad implementation of STS instructional approaches in science classrooms.

The STS leaders have retained their faith in STS education, while becoming more sophisticated about STS issues, instructional approaches, and policy-level changes needed to support the STS innovation. They prescribe creating improved communication links, both among themselves and with decision leaders, and focusing on broad implementation and institutionalization of STS by influencing policy decisions and developing items for standardized tests, text materials, and teacher training programs.

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This work was funded in part under grants from the National Science Foundation, DIR 9048155 and TPE 8751239. The opinions, findings, and conclusions expressed in this article are those of the authors and do not necessarily reflect the views of the National Science Foundation.

The authors gratefully acknowledge the contributions of those interviewed.

BIBLIOGRAPHY

Harms, Norris C. and Robert E. Yager, eds. (1981). Project synthesis Report in *What Research Says to the Science Teacher*, Vol. 3, Washington, D.C.: National Science Teachers Association.

National Science Board Commission on Precollege Education in Mathematics, Science and Technology (1983). *Educating Americans for the 21st Century.* Washington, D.C.: National Science Foundation.

National Science Teachers Association (1982). *Science-Technology-Society: Science Education for the 1980s*, Position Statement. Washington, D.C.: National Science Teachers Association.

COURSE SYLLABUS

PHILOSOPHY, TECHNOLOGY AND THE FUTURE

Philosophy 315

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Introductory Overview:

At California State University, Bakersfield, the Department of Philosophy and Religious Studies regularly offers an upper-division course called *Philosophy, Technology and the Future*. What appears below is a syllabus of the course as offered in the academic year 1990-91.*

For the benefit of readers of this newsletter, some brief explanatory remarks are first provided by way of further explicating the syllabus. With the exception of a four-hour introductory lecture, all class lecture and discussion time was devoted to the five "foci" listed below. With respect to each "focus," or "topic," the strategy of the class was to 1) consider in some detail the historical roots of the technological phenomena in question, 2) examine the contemporary aspects of the phenomena, 3) reflect on possible scenarios for future developments, and 4) consider the points at which the phenomena in question intersect with basic philosophical questions. For the most part, the philosophical questions considered came under the heading of issues in applied ethics and issues in social and political philosophy. Epistemological and metaphysical questions figured in the background of our discussions and only rarely in the foreground.

Results of the student-teacher interactions for each topic were as follows:

Topic 1: Technology and Economic Justice.

Students were assigned reading from the sections of Volume I of Karl Marx's *Capital* which deal specifically with the nature of the labor process before and subsequent to what we today call the "industrial revolution." They also read in its entirety Bluestone and Harrison's *The Deindustrialization of America*.

Almost universally, students were very stimulated by these readings. Of course, they found reading Marx difficult and expressed surprise at what they encountered; most of them came away with an entirely different (and more sympathetic) impression of Marx's thought than they had going in. They also reacted with a kind of nostalgia for the pre-capitalistic age when work was not automated and marked by a higher degree of personal involvement.

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* Two sections of the course were taught by this instructor at off campus locations, one during the Fall quarter in the town of Porterville, California, and the other during the Winter quarter in the town of Bishop, California.

The Bluestone and Harrison book was a "hit." *The Deindustrialization of America* is a controversial book which analyzes trends of the American economy in the 1980s and presents a picture of an America in decline as a consequence of multinational corporate practices--specifically the practice of mergers, disinvestment, "union-busting," etc. It also provides a careful examination of the Japanese economic "miracle" and proposes policy prescriptions for the next decade.

Though the book has its own slant, it is carefully researched and provided the students with a profound awareness of the intimate connection between their own well being and the technological trends and "competitiveness" of their own nation. Philosophically speaking, the most important result of this phase of the course was to connect the problem of distributive justice (specifically, in the context of distribution of employment) with the practice of investment.

Topic 2: Philosophical Questions Surrounding Biotechnology.

For this section of the course one text was used: David Suzuki and Peter Knudtson's *Genethics: the Clash Between the New Genetics and Human Values.* The book begins with four chapters which present a very "reader friendly" explanation of the birds and the bees as we now understand them. It then explores a wide range of ethical questions which haunt the horizons of biotechnology including genetic screening in the workplace, eugenics, transgenic animals, explaining crime genetically, biological weapons, etc. The book is a bit "thin" in terms of professional philosophical argumentation but is scientifically impeccable and perhaps the best introduction available to students of the "brave new world" ahead of us.

Students were certainly interested in this material but displayed less enthusiasm for this topic than the others.

Topic 3: The Impact of Modern Medical Technology on the Experience of Death and Dying.

This topic was approached through a careful examination of Robert M. Veatch's *Death, Dying and the Biological Revolution.* Students found this philosophically sophisticated study challenging because of the density of its prose, but ultimately rewarding. It became clear to them that the metaphysical question of how one obtains an exact definition of death becomes extremely difficult in a society that practices medicine with the aid of electroencephalograms, life support systems, and organ transplant procedures. The bulk of our attention, however, was devoted to ethical questions presented by modern medical technology, e.g. "right to die" questions, with special emphasis upon the procedures for determining the fate of incompetents, questions of distributive justice in the context of allocation of scarce organs, "truth telling" duties of physicians *vis-a-vis* their patients, etc.

Many students had family experiences with respect to these matters and discussion of the question of life support of incompetents was especially keen.

Topic 4: Modern Technology and the Environment.

The main text of this section of the book was Holmes Rolston III's innovative book entitled *Environmental Ethics.* Students also examined the issue of "animal rights" through a reading of Peter Singer's well-known essay, "All Animals Are Equal." Sections of a lesser known book, *Agricide*, by Michael W. Fox, were read. *Agricide* is a hard-hitting exposé of the practices of modern agribusiness.

Rolston's book addresses the old metaphysical question of "man's place in nature" and combines this with an exploration of the axiological question of whether "values" are in nature independently of man or are peculiarly human. The problem of technology is in the foreground of his analysis for reasons that are not far to seek. He locates man "outside" of nature and, not surprisingly, perceives man and his technology as a menace to nature. At the same time, he constructs a convincing axiological system in which he 1) properly insists that uniquely human values are not reducible to nature, 2) posits a set of "natural" values independent of the presence of man, and 3) argues that these natural values add a second set of duties--duties to nature--to those which humans bear to their fellow humans. Rolston is no sentimentalist--he advocates sensible control of technology rather than a renunciation of it.

Rolston also serves as a foil to the radical theses of Singer. He takes issue with Singer's extension of utilitarian principles to the animal kingdom, i.e. his prescription that we maximize their pleasure and minimize their pain. In countering Singer's thesis, he argues for the principle of "non-addition of suffering"--a principle that enjoins us not to ameliorate the natural condition of animals, but simply to refrain from making their condition worse than it is in nature. Fox's study, full of journalistic detail, brought home graphically to the students how the technology of modern farming does in fact make the condition of animals worse than it is in nature.

Students in this area of the country are "greens" and, accordingly, were very interested in obtaining a philosophical perspective of environmental questions.

Topic 5: Nuclear Weapons From a Philosophical Perspective.

The anthology of Avner Cohen and Stephen Lee, *Nuclear Weapons and the Future of Humanity: The Fundamental Questions*, was used in this section of the course. With the aid of an essay by John Holdren they studied the nature of the nuclear "arms race" and what Dwight Eisenhower singled out as the "military industrial complex." It became evident to students that this phenomenon is a case in which, in a sense at least, technology has taken on a life of its own and begun to control man rather than being controlled by him. Traditional philosophical issues of war and peace were considered briefly in this section of the course. Finally, emphasis was put upon understanding the doctrine of deterrence and the problem of dilemmas of disarmament with the help of von Neumann's "theory of games." The best introduction to this approach to deterrence and disarmament proved to be the article of Nicholas Measor: "Games Theory and the Nuclear Arms Race." Some of the other articles listed in the syllabus proved to be too technical for students at this stage of their development.

Of course, at this point in the course students were exhausted and busy with their research papers. Despite this, many of them showed evidence of a real fascination with these problems.

SYLLABUS

Course Goal: As the title of this course indicates, our concern in the coming weeks will be to consider points at which the study of philosophy intersects with facets of technology, and to direct our attention primarily to such points of intersection as are discernible on the horizon, i.e. in the future. As we move along through the subject matter before us, our key motto should be: Focus! The questions before us will be numerous and their implications dramatic. We must be careful that we do not try to deal with all the questions out there--there are just too many of them. And we should not be disappointed if we do not succeed in definitively answering each question we ask--we should be satisfied if we succeed in asking them with precision and a degree of profundity.

I have identified five foci in particular for the coming weeks: 1) technology and economic justice, 2) the ethical dilemmas presented by biotechnology, 3) the ethical dilemmas surrounding death and dying presented by modern medical technology, 4) technology's impact upon the environment and the animal kingdom, and 5) the philosophical questions presented by modern technological warfare (with special attention to nuclear weapons).

Grading: Quizzes: 50%. Each session will begin with a quiz. The quiz will be based on the content of the previous week's class session and the assigned reading. Where the reading assignments are particularly long or difficult, I will limit the amount of material you will be responsible for on the quiz. Your performance on the quizzes will account for 50% of your grade.

Oral Presentations: 25%. Each student will be required to present two brief oral presentations. These presentations may take the form of summarizing for the class a section of the assigned reading for the week and/or a report on the progress of your research paper.

Research Paper: 25%. A 10-15 page research paper will be due on the last day of class. I will expect you to have identified and notified me of your topic by the date of October 3. It should, of course, be concerned with one of the five areas we have identified above; but if you have an exciting idea that departs from the content of the course, I will be willing to consider it.

Readings:

Karl Marx, *Capital*, Vol. 1.

Barry Bluestone and Bennett Harrison. *The Deindustrialization of America: Plant Closings, Community Abandonment, and the Dismantling of Basic Industry*. (New York, N.Y.: Basic Books, 1982).

Holmes Rolston, III. *Environmental Ethics: Duties to and Values in the Natural World*. (Philadelphia, Penna.: Temple Univ. Press, 1988).

Robert M. Veatch. *Death, Dying and the Biological Revolution: Our Last Quest for Responsibility*. (New Haven, Conn.: Yale Univ. Press, 1989).

David Suzuki and Peter Knudtson. *Genethics: The Clash Between the New Genetics and Human Values*. (Cambridge, Mass.: Harvard Univ. Press, 1990).

Avner Cohen and Steven Lee, eds. *Nuclear Weapons and the Future of Humanity: The Fundamental Questions*. (Totowa, N.J.: Rowman & Allanheld, 1986). Only articles below are required readings:
"The Dynamics of the Nuclear Arms Race: History, Status, Prospects," by John Holdren.
"Ecology of Nuclear War: Population, Resources, Environment," by Paul and Anne Ehrlich.
"Morality and Nuclear Politics: Lessons of the Missile Crisis," by Gregory S. Kavka.
"Genocide and Omnicide: Technology at the Limits," by Berel Lang.
"Risking Armageddon," by Russell Hardin.
"The Limits of Allegiance in a Nuclear Age," by Stephen Toulmin.

Michael W. Fox, "The Farming Business." In *Agricide: The Hidden Crisis that Affects Us All*. (New York, N.Y.: Schocken Books, 1986).

Raul Hilberg, "Killing Center Operations." In *The Destruction of European Jews*. (New York, N.Y.: Holmes & Meier, 1985).

Peter Singer, "All Animals are Equal." In *Applied Ethics*, edited by Peter Singer. (New York, N.Y.: Oxford Univ. Press, 1987).

Nicholas Measor, "Games Theory and the Nuclear Arms Race." In *Applied Ethics*, ibid.

Schedule and Reading Assignments:
The following is an itinerary which we may want to modify.

Week of

September 12: Overview of course. Outline of basic questions of philosophy.
Some remarks on the intersection of philosophy and technology, on the history of technology, and on technology in history. How to read Marx.
Read: Marx, pp. 439-91; Bluestone & Harrison, Chs. 1 & 2; Knudtson & Suzuki, Ch. 1.

September 19: A short history of genetics. Eugenics.
Marx on capitalism and the division of labor. Plant closings and unemployment. Where does the concept of justice fit in?
Read: Marx, pp. 492-565; Bluestone & Harrison, Chs. 3 & 4; Knudtson & Suzuki, Ch. 2.

September 26: The "genetic code."
Capitalism and Machinery: Marx on the Industrial Revolution. Who benefits from technological progress? Impact of plant closings on workers and communities. "Frostbelt" and "sunbelt."
Read: Marx, pp. 588-639 (optional); Bluestone & Harrison, Chs. 5-7; Knudtson & Suzuki, Chs. 3-5.

October 3: How DNA works.
"Pax Americana." "How the World Works." Corporate America--pros and cons.
Read: Knudtson & Suzuki, Chs. 6-8; Veatch, Ch. 1; Bluestone & Harrison, Ch. 8.

October 10: "Genethical" questions--crime, screening and therapy.
Survey of medical ethics. Veatch's basic question.
Assessment of Bluestone & Harrison's policy prescriptions.
Read: Veatch, Chs. 2-4; Knudtson & Suzuki, Chs. 11 & 12; Fox, "The Farming Business."

October 17: Impact of technology on our definition of death. Ethical problems of death and dying.
Agricultural technology. Toward an agricultural ethic.
Read: Veatch, Chs. 5-7; Singer, "All Animals are Equal;" Rolston, Ch. 4 (Chs. 2 & 3 if you get time).

October 24: The "living will," truth telling and organ donorship.
"Animal rights." Destruction of habitat.
Read: Rolston, Chs. 6-8; Knudtson & Suzuki, Chs. 9 & 10. Holdren; "Dynamics of the Nuclear Arms Race..."

October 31: Toward an environmental ethic for technology and business.
DNA damage.
History of the nuclear arms race. Biological weapons.
Read: Measor, "Games Theory and the Nuclear Arms Race;" Paul & Anne Ehrlich, "Ecology of Nuclear War;" Lang, "Omnicide and Genocide;" Kavka, "...Lessons of the Missile Crisis."

November 7: Conceptualizing mass destruction. Games theory. Cuban Missile Crisis. Nuclear winter.
Read: Hilberg, "Killing Center Operations;" Toulmin, "The Limits of Allegiance;" and Hardin, "Risking Armageddon."

November 14: Genocide. The Holocaust: Technology gone mad--"the banality of evil."
More on games theory. Disarmament--pros and cons.

OPEN FORUM

ETHICS AND TECHNOLOGY IN CONTEXT: MEDICINE, COMPUTERS, THE THIRD WORLD

Ethics and Technology in Context: Medicine, Computers, the Third World is a desktop-published booklet that collects the GTE-sponsored lectures of Wiebe Bijker (University of Limburg), Deborah Johnson (RPI), and Stewart Oakley (CSU-Chico). It is available gratis, while supplies last, by writing to: Center for the Study of Ethics in the Professions, Attention: ETC Project, Illinois Institute of Technology, Chicago, Illinois 60616.

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TECHNOLOGY AND FEMINISM CALL FOR PAPERS

The special theme for Volume 13 of *Research in Philosophy & Technology* will be "Technology and Feminism." The deadline for receipt of manuscripts is September 15, 1991.

The "Technology and Feminism" theme asks: How do feminism, philosophy, and technology intersect? What is the meaning and impact of feminist philosophic inquiry for technology? How do feminist approaches to ethics and values, to epistemology, to nature and being, to the Other, affect beliefs and attitudes toward technology, its practice and underlying assumptions? Papers reflecting a diversity of approaches and points of view on these and related questions are welcome.

Potential contributors are encouraged to send preliminary inquiries or abstracts prior to submitting manuscripts. To insure blind review, neither the author's name nor institutional affiliation, if any, should appear on the manuscript itself. Please include this information on a separate title page.

In addition to manuscripts on the special theme, papers dealing with general topics in philosophy and technology will be accepted for the "Contemporary Discussion" section. These should go to Frederick Ferré, General Editor, *Research in Philosophy & Technology*, Department of Philosophy, The University of Georgia, Athens, Georgia 30602.

Please direct all inquiries and manuscripts on "Technology and Feminism" to the Guest Editor: Dr. Joan Rothschild, 460 West 24th Street, Apartment 8D, New York, New York 10011. Phone/fax: (212) 645-8339.

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HUMANITIES, SCIENCE, AND TECHNOLOGY (HST) NATIONAL ENDOWMENT FOR THE HUMANITIES

The National Endowment for the Humanities is pleased to announce the availability of grants under the category of Humanities, Science and Technology (HST) for the support of research that brings to bear the knowledge, methods, and perspectives of the humanities on the subjects of science, technology, or medicine. Historical studies and studies of current topics are eligible. However, studies of current science, technology, or medicine must deal with fundamental issues in the humanities. Individuals and institutions are eligible to apply. Applicants may request support for full or part-time salaries, travel, and other costs of conducting research for periods of from one to three years. This category of support is for projects that, because of their intellectual scope and consequent size, duration, or complexity, cannot be accomplished through individual one-year fellowships. Application materials are available from Daniel Jones, Program Officer for Humanities, Science and Technology, Room 318, National Endowment for the Humanities, Washington, D.C. 20506, or call (202) 786-0210. The next deadline for receipt of applications is October 15, 1991.

Forthcoming Meetings and Conferences

September 9-12, 1991. *The Social Mastery of Technology,* Lyon, France. Organized by CNRS Research Group in Industrial Economics and by MRASH (Maison Rhône-Alpes des Sciences de l'Homme). Contact: Jacques Perrin, MRASH, 14, avenue Berthelot, 69363 Lyon, cedex 07-France; Tel.: [33] 72 72 64 67; Fax: [33] 72 72 64 72.

Setember 27-October 2, 1991. *Confronting Environmental Challenges in a Changing World.* 20th Annual Conference of the North American Association for Environmental Education, St. Paul, Minn. Contact: NAAEE Conference Headquarters, P. O. Box 400, Troy, OH 45373; [513] 698-6493.

October 10-13, 1991. *Science and Literature: Beyond Cultural Construction.* Annual Meeting of the Society for Literature and Science, Montreal. Contact: David Lux, Bryant College, 450 Douglas Pike, Smithfield, RI 02917; Bitnet: LDM116@URIACC.

October 17-18, 1991. *Interface '91: Fifteenth Annual Humanities and Technology Conference*, Metro Atlanta. Contact: Tom Wiseman or Mark Stevens, Dept. of Humanities and Social Sciences, Southern College of Technology, 1100 S. Marietta Parkway, Marietta, GA 30060-2896; [404] 528-7202.

October 31-Nov. 3, 1991. *Critical Problems and Research Frontiers in History of Science and Technology.* Society for the History of Technology and History of Science Society, Joint Annual Meeting, Madison, Wisc. Contact: SHOT Program Chair--Deborah Fitzgerald, 1225 Orchard Drive, Ames, IA 50010; [515] 232-5809 or HSS Program Chairs--Albert Moyer and Richard Hirsh, Dept. of History, Virginia Tech., Blacksburg, VA 24061-0017; Bitnet: AEMOYER@VTVM1 or RICHARDS@VTVM1.

November 13-16, 1991. *Society for Social Studies of Science,* Annual Meeting, Cambridge, Mass. Contact: Program Chair, Ellsworth Fuhrman, Science Studies Center, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0247; [703] 231-7687; email: FUHRMAN@VTVM1.BITNET.

January 12-16, 1992. *III CLAHCT--Third Latin American Congress of the History of Science and Technology, Mexico City.* General theme: America in the formation of a new world: 500 years of scientific exchange. Contact: Comité Organizador III CLAHCT, Arpartado postal 21-873, 04000, México, D.F., Mexico.

February 6-9, 1992. *7th Annual Technology Literacy Conference,* National Association for Science, Technology and Society Annual Meeting, Washington, DC. Session/paper proposals due by October 1, 1991. Contact NASTS Headquarters, 133 Willard Building, Pennsylvania State University, University Park, PA 16802; Phone: [814] 865-9951; Fax: [814] 865-3047.

May 2-3, 1992. *DIAC-92--Directions and Implications of Advanced Computing,* Berkeley, Calif. 4th DIAC Symposium sponsored by the Computer Professionals for Social Responsibility. Paper proposals (4 copies) due by November 1, 1991. Contact: Program Chair: Douglas Schuler, 2202 N. 41st St., Seattle, WA 98103; [206] 632-1659 (home); [206] 865-3832 (work), EMAIL: dschuler@june.cs.washington.edu.

August 12-15, 1992. *4S/EASST,* Gothenburg, Sweden. The Society for Social Studies of Science annual meeting will be held jointly with the European Association for the Study of Science and Technology. Session proposals due by October 31, 1991; paper proposals due by January 31, 1992. Contact: John Hultburg, Center for Science Studies, Univ. of Gothenburg, S-41298 Gothenburg, Sweden. Phone: 46-31-631929; Fax: 46-31-634723.

August 16-21, 1992. *Society for the History of Technology*, Annual Meeting, Uppsala University, Sweden. Paper proposals due by October 1, 1991. Contact: Håkon With Andersen, Center for Technology and Society, Univ. of Trondheim at Lade, N-7055 Dragvoll, Norway. Phone: 47-7-591789; Fax: 47-7-591327; Bitnet: H_Andersen@AVH.UNIT.UNINETT. For conference information contact: Uppsala Turist & Kongress, "SHOT," Box 216, S-751 04 Uppsala, Sweden. Fax: 46-18-132895.

M*E*T*A*

Mankind, Ethics, Technology, and the Arts

Recent Publications

BROWN, LESTER R., ET AL. STATE OF THE WORLD--1991. WASHINGTON, D.C.: WORLDWATCH INSTITUTE, 1991. XVII, 254 P. PAPERBACK: $10.95.

This year's State of the World, the Worldwatch Institute's eighth compilation, focuses in part on partially replacing income taxes with environmental taxes as a mechanism for environmental preservation and sustainable development. Specific titles and contributors include: "The New World Order," by Lester R. Brown; "Designing a Sustainable Energy System," by Christopher Flavin and Nicholas Lenssen; "Reducing Waste, Saving Materials," by John E. Young; "Rethinking Urban Transport," by Marcia D. Lowe; "Reforming Forestry," by Sandra Postel and John C. Ryan; "Restoring the East European and Soviet Environments," by Hilary F. French; "Coming to Grips with Abortion," by Jodi L. Jacobson; "Assessing the Military's War on the Environment," by Michael Renner; "Asking How Much Is Enough," by Alan Durning; and "Reshaping the Global Economy," by Sandra Postel and Christopher Flavin.

HARKANYI, KATALIN, COMP. THE NATURAL SCIENCES AND AMERICAN SCIENTISTS IN THE REVOLUTIONARY ERA: A BIBLIOGRAPHY. BIBLIOGRAPHIES AND INDEXES IN AMERICAN HISTORY, NO. 17. WESTPORT, CONN.: GREENWOOD, 1990. XI, 511 P. HARDCOVER: $65.00.

This bibliography covers scientific activities during the American Revolutionary Era, ca. 1760-1789 and includes works published through the twentieth century. The work is divided into three parts. Part I, the largest section, provides an overview of the natural sciences in the Revolutionary Era. Comprehensive and general sources are listed in the fields of "natural history" (botany, zoology, agriculture, and geology), "natural philosophy" (mathematics, chemistry, astronomy, surveying, engineering, and architecture), and medicine (dentistry, pharmacology, and veterinary medicine). Included are journals, documents, biographies, bibliographies, histories, orations, and even travel journals and diaries which create a framework for the study of Revolutionary American science. Part II is devoted to the scientists themselves: the men and women who wrote partial or specific scientific studies. This section of the book shows that these early Americans were capable of remarkable investigations into the natural world, rivaling their European contemporaries. Here are listed the scientists, their extant monographic works, and studies written about them from their age into the twentieth century. Part III includes appendices of scientific firsts and special achievements of Revolutionary Americans and a list of scientists arranged by discipline.

MITCHAM, CARL AND MARGARITA M. PEÑA BORRERO WITH ELENA LUGO AND JAMES WARD. EL NUEVO MONDO DE LA FILOSOFIA Y LA TECNOLOGIA. UNIVERSITY PARK, PENN.: STS PRESS, PENNSYLVANIA STATE UNIVERSITY, 1990. VIII, 316 P. PAPERBACK: $10.00.

This collection of 32 papers, 22 abstracts, and an introduction is the Spanish language proceedings of the First Interamerican Congress on Philosophy of Technology, held at the University of Puerto Rico in Mayagüez in October 1988. Of perhaps special interest to STS readers is Part Three, "Science, Technology, and Education," with contributions by Fernando Agrait (former president of the University of Puerto Rico). Paul T. Durbin, Margarita Peña Borrero (currently an undersecretary of education in Colombia), Luis Piscoya Hermoza (Peru), and Rustum Roy. Copies are available from the STS Press, Willard Bldg. 133, Penn State University, University Park, PA 16802.

SCHURR, SAM H.; CALVIN C. BURWELL; WARREN D. DEVINE, JR.; AND SIDNEY SONENBLUM. ELECTRICITY IN THE AMERICAN ECONOMY: AGENT OF TECHNOLOGICAL PROGRESS. CONTRIBUTIONS IN ECONOMICS AND ECONOMIC HISTORY, NO. 117. WESTPORT, CONN.: GREENWOOD AND ELECTRIC POWER RESEARCH INSTITUTE, 1990. XV, 445 P. HARDCOVER: $45.00.

The authors relate expanding electric usage in various industrial production applications with technological "progress" during the 20th century. Case studies make up eleven of the volume's thirteen chapters, while the remaining chapters and a statistical appendix cover broad quantitatively-based findings. Extensive data included in numerous tables and figures.

WIEGELE, THOMAS C. BIOTECHNOLOGY AND INTERNATIONAL RELATIONS: THE POLITICAL DIMENSIONS. GAINESVILLE: UNIV. OF FLORIDA PRESS, 1991. X, 212 P. BIBLIOG. HARDCOVER: $22.95.

Wiegele offers an introduction to the points at which biotechnology and international politics intersect. Following a summary of the broad international context, the author provides an overview of the meaning of biotechnology or genetic engineering--definitions; impacts on health, agriculture, and industry; key policy issues such as laboratory safety and environmental release; university-industry relationships, etc. He then provides three detailed, chapter-length looks at the impact of biotechnology on specific policy issues: law, commerce, and war. In his final chapter Wiegele calls on his colleagues--professional political scientists--to address these issues more directly in the hopes of contributing to a better understanding of biotechnology. He concludes by outlining a research agenda for the 1990s.

WILKINS, LEE AND PHILIP PATTERSON, EDS. RISKY BUSINESS: COMMUNICATING ISSUES OF SCIENCE, RISK, AND PUBLIC POLICY. CONTRIBUTIONS TO THE STUDY OF MASS MEDIA AND COMMUNICATIONS, NO. 27. WESTPORT, CONN.: GREENWOOD, 1991. XXII, 230 P. BIBLIOG. HARDCOVER: $42.95.

Fifteen essays focusing on media coverage of science, technology, medicine, and disasters/hazards from the perspectives of sociology, psychology, philosophy, and journalism. Dorothy Nelkin provides a foreword entitled "Why Is Science Writing So Uncritical of Science?" Following a brief introduction by the editors (who also offer concluding remarks), twelve essays focus broadly on Nelkin's title question and its somewhat surprising counterpart, "Why Are Scientists So Critical of the Press?" Included are: "Risk Perceptions as Substance and Symbol," by Robin Gregory; "Coming to Terms with the Impact of Communication on Scientific and Technological Risk Judgments," by Sharon Dunwoody and Kurt Neuwirth; "Risk Management: The Public versus the Technical Experts," by Sharon M. Friedman; "Popularization versus Secularization: Media Coverage of Health," by Robert A. Logan; "The Stigma of Mental Illness: Labeling and Stereotyping in the News," by Russell E. Shain and Julie Phillips; "Media Coverage of Technology Issues: Ethiopian Drought of 1984, AIDS, Challenger, and Chernobyl," by Everett M. Rogers and Soon Bum Chang; "A Cross-Societal Comparison of Disaster News: Reporting in Japan and the United States," by E. L. Quarantelli and Dennis Wenger; "Organizational Communication and Technological Risks," by Phillip K. Tompkins; "The Security of Secrecy," by David M. Rubin; "A Case of Need: Media Coverage of Organ Transplants," by Deni Elliott; "Science as Symbol: The Media Chills the Greenhouse Effect," by Lee Wilkins and Philip Patterson; and "Disasters and the Making of Political Careers," by Sue O'Brian.

OTHER WORKS RECEIVED

FARKAS-CONN, IRENE S. FROM DOCUMENTATION TO INFORMATION SCIENCE: THE BEGINNINGS AND EARLY DEVELOPMENT OF THE AMERICAN DOCUMENTATION INSTITUTE--AMERICAN SOCIETY FOR INFORMATION SCIENCE. WESTPORT, CONN.: GREENWOOD, 1990. XIII, 231 P. HARDCOVER: $49.95.

The American Society for Information Science (ASIS) began in 1937 as the American Documentation Institute (ADI).

YOUNG, JOHN E. DISCARDING THE THROWAWAY SOCIETY. WORLDWATCH PAPER, 101. WASHINGTON, D.C.: WORLDWATCH INSTITUTE, 1991. 45 P. PAPERBACK: $4.00.

SEVENTH ANNUAL TECHNOLOGICAL LITERACY CONFERENCE

February 6-9, 1992

Radisson Mark Plaza Hotel, Alexandria, VA

CALL FOR PARTICIPATION

The Planning Committee for the Technological Literacy Conference invites you to submit a proposal to participate in the Seventh Annual Technological Literacy Conference, the national gathering of the STS community. The committee will consider proposals for the following types of presentations:

Hands-on workshops and activities (1 hour)
Papers, tutorials, or case studies (20 minutes)
Roundtable or panel discussions (1 hour)
Posters (on display 2 hours)

Conference Themes

We will again hold special lectures and presentations organized around the following themes:

Education and Information
Environment
Health and Biomedicine
Moral, Ethical and Philosophical Perspectives
Technology, Industry and Work

TLC-7 REGISTRATION FEES

For new or renewing NASTS members (memberships expire 1/1/92):

Membership renewal for 1 year (includes newsletter)	$40
Early TLC registration (by Dec. 1)	$80
Registration after Dec. 1	$95
Weekend (Sat/Sun) registration	$60
Student registration (includes membership)	$40

For non-members:

Early TLC registration (by Dec. 1)	$130
Registration after Dec. 1	$145
Weekend (Sat/Sun) registration	$110

Audio/Visual Equipment Rental Fees:
Due to the increasing demand for A/V equipment, we need to ask users to pay a small portion of the equipment rental costs: Slide projector, $15. Overhead projector, $15. VCR and monitor, $25. Flip chart, $5.

About the Radisson Mark Plaza Hotel:
This year we will hold TLC-7 at the Radisson Mark Plaza Hotel, located in Alexandria, Virginia, just to the southwest of Washington, D.C. Our conference site committee and staff were very impressed by its relaxed atmosphere, easy-to-understand layout, diversity of eating facilities, and recreational amenities (indoor pool, racquetball/handball courts, and exercise equipment). The hotel is located adjacent to an 80-acre nature park with a lake and jogging trails. The hotel provides complimentary shuttle services to the National Airport and Metrorail Station. Room rates will be $95 per night (single or double) plus tax.

CONFERENCE FEATURES

Plenary Speakers: experts and leaders in the STS community (Thursday pm; Friday am; Saturday am & pm; Sunday am).

Invited Theme Programs: special presentations by noted individuals in the areas of Education & Information; Environment; Health and Biomedicine; Moral, Ethical and Philosophical Perspectives; and Technology, Industry and Work.

Community Breakout Sessions: discussion groups, organized by professional "communities," held immediately after morning plenary sessions.

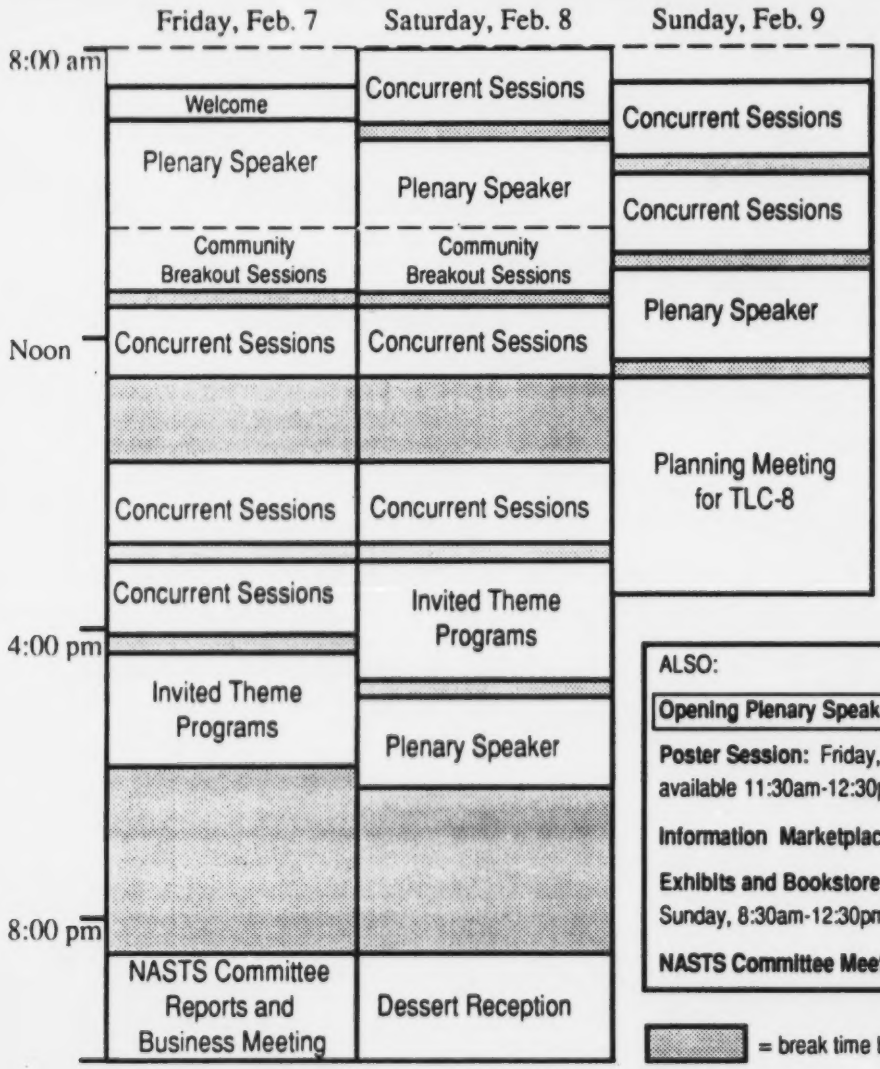
Concurrent Sessions: papers, tutorials, case study reports, workshops, roundtable discussions, and posters presented by conference participants.

Information Marketplace: a two-hour event early Friday afternoon featuring representatives and materials from educational institutions, governmental agencies, and non-profit organizations.

Exhibits and Bookstore: publishers, vendors of educational materials, and non-profit groups on exhibit throughout the conference.

Dessert Reception: coffee, tea, and desserts and a convivial atmosphere for mingling with friends and making new acquaintances! (Saturday evening)

NASTS Business Meeting & Committee Meetings: an opportunity to become involved in various NASTS programs and projects. (Committee Reports & Business Meeting, Friday evening; Committee Meetings, Saturday lunch)



Seventh Annual

TECHNOLOGICAL LITERACY CONFERENCE

February 6-9, 1992
Radisson Mark Plaza Hotel
Alexandria, VA

ALSO:

Opening Plenary Speaker: Thursday, 7:30-9:30 pm.

Poster Session: Friday, on display 11:30am-1:30pm (presenters available 11:30am-12:30pm).

Information Marketplace: Friday, 11:30am-1:30pm.

Exhibits and Bookstore: Friday & Saturday, 8:30am-5:30pm and Sunday, 8:30am-12:30pm.

NASTS Committee Meetings: Saturday, 12:30-1:30pm (working lunch).

= break time between sessions or for meals.

Technological Literacy Conference (TLC-7) Proposal Form

Title of Presentation: _____

	Presentor	(Co-Presentor)	(Co- Presentor)
Name:			
Institution:			
Address:			
Phone:			

Please note any special circumstances that would affect the scheduling of your presentation. We will try to accomodate your requirements to the best of our ability:

Preferred format: ❒ Paper, Tutorial, or Case Study (20 minutes) ❒ Poster (on display 2 hrs; presentor available 1 hr.)
❒ Panel or roundtable discussion (1 hour) *Moderator:* _____ ❒ Hands-on workshop (1 hr.)

Equipment needs: ❒ overhead projector (fee: $15) ❒ 2" x 2" carousel slide projector (fee: $15)
(and rental fees) ❒ standard-size VCR (VHS) and monitor (fee: $25) ❒ flip-chart (fee: $5)

Notes: Please return your completed proposal form by **October 1, 1991** to: Conference Manager, NASTS, 133 Willard Building, University Park, PA 16802. (Tel.: 814-865-9951; FAX: 814-865-3047.) Proposals will be evaluated by the Proposal Review Committee, a peer-review panel. If the proposal is accepted, all presentors listed above must register for the conference and pay appropriate registration fees by December 1, 1991 to be included in the program. **Due to the increasing demand for audio-visual equipment at the TLC, we need to ask users to pay a small portion of the equipment rental costs.** This amount will be collected with the registration fees.

Abstract of Presentation. Please write a description (250 words maximum) of your presentation. Include a statement of the steps you will take to involve the participation of attendees. (All presentations must leave time for audience participation. Posters will be on display Friday, 11:30 am-1:30 pm; presenters will need to be available for questions 11:30 am-12:30 pm.)

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RETURN PROPOSAL FORM TO: NASTS, 133 Willard Bldg., University Park, PA 16802

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Science, Technology and Society Program
327 Maginnes Hall #9
Lehigh University
Bethlehem, PA 18015

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Sciences, Technology & Society is a newsletter devoted to the general area of science, technology, and society studies. It is a joint project of the Lehigh University STS Program and the Technology Studies Resource Center and publishes short articles on the theoretical and speculative aspects of curriculum development, in-depth program and course descriptions, reviews of texts and audio-visual aids, and an annotated bibliography of current books and articles. An "Open Forum" section exists for readers with questions, comments or announcements regarding STS activities or needs. Our goal is to help generate new courses, and provide an information exchange, in the STS field.

Subscriptions, covering six issues, are available for $8.00 per year. Back issues are available for $1.50 each.

Please address all materials for publication and correspondence to:

Dr. Stephen H. Cutcliffe, Editor, STS Newsletter
STS Program, 327 Maginnes Hall #9, Lehigh University
Bethlehem, PA 18015.

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Science, Technology & Society

Curriculum Newsletter of the Lehigh University STS Program & Technology Studies Resource Center

Editor: Stephen H. Cutcliffe
Guest Editor: Michael R. Notis

No. 85, September 1991
ISSN: 0275-8075

KNOWLEDGE, POWER AND BLACK BOXES: AN APOLOGIA FOR THE SOCIOLOGY OF TECHNOLOGY

When I was twelve years old, I was sure that I would grow up to be an aeronautical engineer (in those far-off days the term "aerospace" had not been coined). After a number of academic twists and turns I ended up a sociologist. Yet my interest in technological hardware had not left me, and with my first academic appointment I began to teach a course on the sociology of technology. (I am somewhat embarrassed to report that the course was entitled "Men and Machines"--we have made some progress since then in reducing sexist language!). Then, as now, the field was peripheral to mainstream sociology, and there was no standard set of themes, topics, facts, and methodologies. This left me free to define the course as I saw fit, a process that continues to this day.

Although a sociological inquiry into technology is not part of the established sociology curriculum, it is still grounded in the central concerns of the discipline, for there are many natural connections between the sociology of technology and the kinds of issues that engage sociologists of all descriptions and specialties. The sociological relevance of the study of technology follows from the axiomatic principle that technology is a social creation. Tools, techniques, materials, and the organizational systems that tie them together do not appear through spontaneous generation, nor are they simply the product of individual human genius. The technologies found in a particular society have been shaped by the distribution of wealth and income, cultural patterns, and power relationships. A course on the sociology of technology therefore will naturally gravitate towards such themes as the rise of the factory system, the role of the military, corporate and governmental influence over technological development, and the "modernization" of "traditional" societies.

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None of this is likely to be a revelation to the readers of this newsletter. Although each sociologist will have his or her distinctive approach to the study of technology, it will not be totally idiosyncratic, much of it will be consonant with the prevailing paradigms, theories, themes, and topics of mainstream sociology. But what about the non-sociological content? Specifically, to what extent does an adequate sociology of technology require an understanding of technology itself? Should a sociologist be content with treating particular technologies as so many "black boxes"? Can we be satisfied with a description and analysis of the social inputs and outputs of these boxes, with scant concern for their contents?

This general issue is not confined to the sociological study of technology. Similar concerns have engaged scholars working in the related fields of the history and sociology of science. Here, an "internalist" science-oriented study of science has been challenged by an "externalist" approach concerned with the social, economic, political, and cultural dimensions of science and its development. As sociologists, we have rallied behind (and helped to create) the fundamental idea that science is a social creation that cannot be reduced to an abstract intellectual process. Yet at the same time, it seems evident that a sociological inquiry has to be complemented by an adequate comprehension of the science itself. Social arrangements are important, but so too are ideas; the task of the sociologist of science is to chart the interaction of the two. Without an understanding of the ideas themselves, a sociological inquiry into the development of science is likely to be a one-dimensional exercise.

The same can be said of the sociology of technology. But if at some point it becomes necessary to pry open the black box, how widely should it be opened? This is something that many of my students have wondered about. On occasion, after an overly detailed lecture on the Newcomen engine or the principles of a transistor's operation, a student will voice the question that others are surely thinking: "Are we going to be tested on this?" It is a reasonable question. An adequate response must include some justification for the inclusion of technical material into a class in sociology.

In the first place, it can be argued that a knowledge of the actual technological products and processes are necessary if one is to comprehend the modern world and effectively function in it. Civics courses are taught on the premise that an educated public is necessary if informed choices are to be made in the political arena. A similar argument can be made about the need to support intelligent choices of the

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technologies we pay for, either directly or through our taxes.

This is an argument that probably should not be pushed too far; exposure to a civics class does not seem to make much difference in a student's level of political knowledge. In promoting the comprehension of technology or the workings of government, one course can only do so much. If a comprehensive understanding of today's technologies is the goal, the effort is doomed to failure. But a higher degree of technological sophistication might at least induce a healthy skepticism regarding the claims of advertisers, corporate managers, government officials, military brass, and other self-interested purveyors of new technologies. On a somewhat more general level, a greater familiarity with actual technologies can help to demystify technology, thereby alleviating the sense of impotence we often experience when confronted with massive and massively complex technological systems. Although it does not resolve any of the key issues, there is still something fortifying about having the knowledge that the sole purpose of a commercial nuclear reactor is to boil water (in order to run steam-powered turbine that drives an electrical generator). The details of many technologies are wondrously complex, but the basic principles of their operation are not difficult to grasp. As long as its limitations are not ignored, a higher level of technical knowledge will enhance our capabilities as scholars and citizens. Knowledge does not always translate into power, but ignorance generally insures weakness.

A better understanding of actual technologies also can help us to avoid a trap easy to fall into: an unwarranted enthusiasm for technological fixes to social problems. The study of a particular technology will demonstrate that it is designed to do a particular task, and that the less ambiguous the task, the better the technology performs. Many problems, especially social ones, are anything but unambiguous. Technology can solve some problems, but not all of them. An understanding of specific technologies can go a long way toward clarifying the difference.

Next, the study of specific technologies leads one easily to the idea of a system. The notion that the social order can also be conceptualized as a system is a very old one in the history of sociology, and in its naive form it has been misleading or worse as a representation of how societies actually work. Even so, there is considerable value in thinking through the interconnections found in the social order, especially when these are seen as points of conflict as well as accord. The study of technology can help to revitalize the old and honorable tradition of studying society in its fullness. This would be a salutary outcome for a discipline that has too often been absorbed with narrow studies of seemingly isolated social phenomena.

Perhaps the effort to comprehend society in these terms smacks too much of intellectual hubris. Paradoxically, however, a study of individual technologies operating within a system can provide a healthy dose of humility. Intellectual arrogance may not be as evident in sociologists as it is in, say, economists. Still, we want to be taken seriously, and would like to think that sociological theory and research can make a contribution to the emergence of a

racially integrated society, more productive workplaces, safer streets, more livable communities, and so on.

It is entirely proper that we have such aspirations; from its inception, sociology has never been simply an intellectual exercise disconnected from basic human needs and concerns. There is a place for social engineering, but at the same time, some experience with the products and processes of actual engineering is likely to leave us with a better appreciation of the magnitude of the task. It is vastly easier to design a new microprocessor or steam turbine than it is to design effective policies and programs for countering drug addiction or adolescent pregnancy. By their nature, technological tasks tend to be more limited in both their objectives and the variables that need to be taken into account. Under these circumstances, success is more likely; anyone who has written a useful computer program or modified an engine to attain higher performance has experienced what Sherry Turkle has described as "closed system ecstasy." Yet even here, success only comes after overcoming uncertainty, false starts, and unexpected interactions between separate components. As sociologists, we still have the obligation to mobilize our intellects, expertise, and imaginations in the effort to make a better society. But we should not harbor any illusions about the magnitude of the task. Some time spent troubleshooting a malfunctioning electrical circuit or reading about Rudolf Diesel's decade-long effort to produce a more thermally efficient internal combustion engine could yield considerable insight into the difficulties of creating something that is both new and effective.

Every sociologist has a unique set of interests, concerns, and avenues of inspiration. Not all will share my interest in technology as both a subject for sociological inquiry and a source of insight. Nor are they likely to set aside their books, questionnaires, and tabulations of survey data in order to pursue a course in mechanical engineering. Yet our technologies are as much social creations as our prisons, bureaucratic organizations, and patterns of personal interaction. A sociology that excluded these major components of the social system would be hopelessly incomplete. Perhaps the day will come when sociologists say the same thing of technology.

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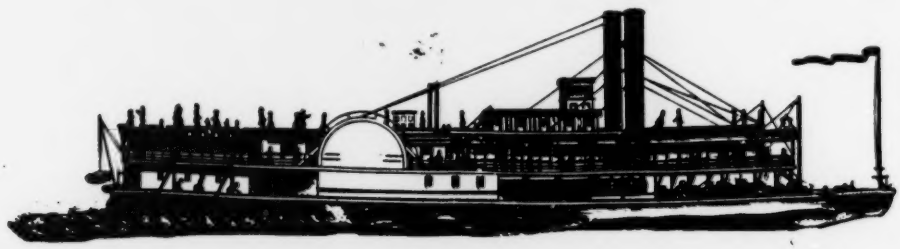
This essay originally appeared in the Newsletter of the American Sociological Association Section on *Science, Knowledge and Technology* 4 (July 1991): 2-5 and is reprinted here by permission.



A CONFERENCE ON THE INFLUENCES OF JAPANESE/AMERICAN CULTURE ON TECHNOLOGICAL INNOVATION IN ADVANCED MATERIALS

In December 1990 a week-long conference on "The Influences of Japanese/American Culture on Technological Innovation in Advanced Materials" was held at the University of Arizona. Roughly half the participants were scientists or engineers who have been or are successful researchers, managers, and innovators playing leadership roles in materials research and development; these participants were equally divided between Japanese and Americans. In order to have a fairly narrow and focused discussion, the participation was limited to those working on only three types of advanced materials in the pre-commercial, nascent, or infant commercial stages of development. Another quarter of the participants were active or former successful managers of materials development and/or serious scholars studying innovation and technology transfer. The final quarter of participants consisted of anthropologists and sociologists, most of whom had little or no background in technology or technological innovation. In a very real sense the conference was an experiment in an emerging field that I shall call the anthropology of technology. No short summary can adequately summarize discussions of what is inherently a complex and messy subject. Thus, a complete proceedings of the conference, *Japanese/American Technological Innovation*, will be published by Elsevier Science Publication.

Until about twenty years ago the history of technology was dominated by detailed narrative descriptions which were generally positivist and reductionist. Historians of technology refer to this as an internalist view of technology that is seen as somehow independent of the surrounding society. It was a widely held view that technology was responsible for social change rather than vice versa--technological determinism. Progress was taken as inevitable, and more often than not the mechanism of progress was seen as a linear progression from pure science to applied science (equated with technology) to engineering and manufacturing. This is a process that can be directed and controlled by following a progression from research to development to production and marketing. In the last two or three decades a "new" and more realistic history of technology has developed which focuses on technological change and views technology as a system that involves social organization, management behavior, human perceptions, environment, culture, economics, and politics as important formative factors. It contends that technological systems must be seen in the social and cultural context in which they are constructed. The engineering community is now beginning to recognize and accept this perspective also. The topic of the 1990 National Academy of Engineering Annual Meeting Symposium was "Engineering as a Social Enterprise."

In discussing technological innovation in some depth, we are somewhat on the horns of a dilemma. We need the participation of the

scientific and engineering craftsmen who are out there doing the innovation and have firsthand knowledge of what is actually happening. But their model for such a discussion often tends to be one of technological determinism and an almost inevitable sequence of events that we know to be false or misleading. We addressed this problem by bringing the technologists and managers together with anthropologists who have little background in technical detail but do have a presumed sensitivity to the social and cultural contexts of technological activities and socio-technological change. In a further restriction on the scope of our endeavor, the conference topic was limited to influences of cultural differences--specifically between Japan and the United States--on technological innovation. We chose to focus on Japan vis-à-vis the United States for two reasons: first there are distinct cultural differences which many books and articles have associated with relative success in science, technology, and corporate management; second, Japan and America are world leaders in the field of advanced materials.

Culture refers to the framework of behavior, beliefs, and customs common to a society, the structure within which events and behavior are interpreted, the values and expectations within which the world is ordered. Japan and America have national cultures, but there are also a variety of subcultures associated with smaller social organizations such as universities, national laboratories, and corporations within which technological innovation occurs. Cultures are shaped by a variety of influences and change over time. The national cultures of both Japan and the United States are continually changing and sometimes thought to be converging. In the United States, the changing role of women has led to revolutionary changes in the family and the workplace. Managers of American national laboratories and many companies are actively attempting to modify their laboratory or corporate culture. Japanese women are traditionally rarely seen in technological and managerial roles, but that too seems to be changing. Traditionally, Japanese salarymen have lifetime employment, and work is the most important activity in their lives. But there is some fraction of the generation under age 30, the "Shinjinrui", who are not afraid to change jobs, who want to avoid the "three k's"--*kiken* (dangerous), *kitsui* (hard) and *kitanai* (messy). *Shinjinrui* are said to care more about their pleasures than their work. Cultural contexts are deeply embedded and difficult to alter, but we must understand that our conference was populated mostly by participants in the 35-65 year age group. It is that strata of our societies, leaders of this and coming decades, who were discussing and being discussed.

Advanced materials are a particularly appropriate area of technology for a meeting such as this. Materials are an enabling technology that make possible improved performance of devices critical to the improved performance of more complex systems. As such, these materials contribute more to high-value-added manufacturing than their own cost or market value. Almost a century ago, development of electrical lighting systems was dependent upon the development of new materials for the filaments of incandescent bulbs as a critical component of much larger electrical systems which included generating stations, transformers, power lines, and new financial institutions. There were improved carbon filaments, bulbs with incandescent solid electrolyte Nernst glowers, and a variety of refractory metals. In the end, drawn-wire tungsten allowed the development of brighter, longer-life incandescent lighting which made the whole system more efficient and effective. The same can be said for ceramic ferrite, magnetic memory devices which transformed the development of early computer systems. All industries and all systems are limited by the performance of materials as components. If we

had lighter metals..., if we had tougher ceramics..., if we had higher temperature superconductors....

In mature industries, those such as binoculars, cameras, clock and watches, and calculators, microwave ovens, motorcycles, semiconductors, tape recorders, television receivers, and VCRs, amongst others, it is clear that Japanese innovations have led the world and enabled Japan to capture a significant market share. Dozens of analyses and interpretations have been published. Technological innovations have been accompanied by the development of a Japanese manufacturing system which combines high quality with low cost of production. This has been achieved by flexible manufacturing schedules with relatively short production runs of several closely related products. Manufacturing concerns in Japan have considered the development and well-being of human resources as a principle objective. This has led to workers cross-trained over a range of skills, effective participation and acceptance of responsibility at all levels of the hierarchy, and an organizational approach of cooperative work groups which range across a variety of related disciplines and include technicians and craftsmen as well as engineers. There is an emphasis on seeking consensus, open communication, and decision-making as close as possible to the point of implementation. Finally, there are strong communications and interactions with customers and suppliers which provide rapid feedback into design, production, and engineering.

The conference was concerned with the earlier stages of product development and particularly the invention of new products and processes and their development in nascent and infant industries. At this stage of the innovation process, there has been much less comparison of Japanese and American industries. The nucleation and growth of new industries may well be the critical step in the development of *new high-value-added manufacturing. It is often* stated that the United States is the source of major new concepts and products for which the Japanese devise more effective manufacturing processes. That reductionist picture is one that requires careful examination. In order to focus our discussions, we selected three advanced materials that are widely considered to be harbingers of the future. In 1986 the discovery and confirmation of high temperature oxide superconductors unleashed extensive international research which has led to these materials being on the threshold of commercial innovation. Synthetic diamonds formed at low pressures have been undergoing technological development for about ten years, and commercial products are now being manufactured on a limited scale. Silicon nitride structural ceramics have been actively pursued for almost forty years and are now in regular production in what may be described as an infant industry. Taken as a group, these advanced materials provide insights into the progression from invention to nascent commercialization to infant industry.

The idea that Americans are highly creative and that the Japanese have taken our breakthroughs and then transformed them into commercial success has come to be accepted wisdom in many circles. Our discussion of the discoveries associated with high temperature superconductors and with low pressure diamond synthesis provided no support for this view. In high temperature superconductors where Japanese and American researchers have left the starting gate together, the rate of new discoveries has been pretty much equal. Japanese research has been as creative as their American counterparts and vice versa. Similarly, in the discovery phase of low pressure diamond synthesis, the Japanese have taken the lead. Dr. Robert DeVries, a distinguished General Electric Company researcher in the field and author of several histories, has said: "Most of the creative advances in CVD diamond are of Japanese

origin." In consequence it seems that many analyses of American vs. Japanese creativity as resulting from different educational systems, for example, are based on a faulty premise and largely without merit.

It is clear, however, that the number of Nobel prizes in the basic sciences that have been garnered has been overwhelmingly in favor of U.S. scientists. The conference discussions suggested that this may result from a profound difference in the Japanese and American concepts of "science" and of learning. In the United States the essence of science is taken as the development of principles and laws that can serve as fundamental concepts underlying future experiments and provide a basis for technological development, while in Japan science is taken as a process of methodical experimental approach toward learning. Experimental results are important because an experimental fact is "truth." Explanations and interpretations are less important. In the examples of advanced materials we have discussed, this Japanese concept of science has led them to focus more strongly on processing of materials and synthesis. In contrast, American research has been much more dominated by characterization of materials based on condensed state physics. Japanese participants suggested it is possible to develop a science of manufacturing analogous to computer science. In contrast, most American participants suggested that manufacturing was a socio-technological activity depending heavily on human behavior, human perceptions, and social organization. As a result, manufacturing analysis involves thousands, perhaps millions, of variables which can never be reduced to a "science." There was the view that a reductionist Taylorism approach to time and motion studies, or any more comprehensive models that developed, hardly warranted the application of the word "science."

This fundamental conceptual difference is deeply embedded in the American and Japanese cultures. It was influential in many aspects of our discussions. On the American side there is a national consensus that science is the goose that lays the golden eggs which inevitably lead to applied science, technology, innovative manufacturing, and a better quality of life. This has been shown to be myth by many historians of technology, nonetheless, it is a widely and deeply held view of most scientists, policy makers, legislators, and ordinary people. A successful moon landing is widely perceived as a scientific success, while the *Challenger* disaster was viewed as an engineering failure. AAAS President Leon Lederman has proposed that we should increase science funding so that every American physicist, chemist, and biological scientist is fully supported. This has also led to bifurcation of the science and engineering communities in the United States. It is exemplified by our separate National Academy of Science and National Academy of Engineering. By and large the intellectual pecking order places scientists above engineers. Many in the advanced materials community feel that the ten billion or so dollars funding the superconducting super collider program would be better devoted toward technology which would enhance American competitiveness. But there exists no national American consensus as to the importance, perhaps even the desirability, of technological innovation.

By contrast, in Japan science and engineering are seen as constituents of a single community. There is, in Japan, an air of technology enthusiasm, which has passed into history in the United States. Thomas P. Hughes, in his book *American Genesis*, quotes Perry Miller who described American exhilaration with technology at the turn of the century. Americans "flung themselves into the technological torrent, how they shouted with glee in the midst of the cataract, and cried to each other as they went headlong down the chute that here was their destiny...." This same spirit seems to exist now in Japan and is exemplified by what has been

described as a "ceramic fever" engaging all segments of the population during the 1970s. There is a Japanese national consensus shared by scientists, engineers, corporate CEO's, politicians, legislators, and ordinary people that their country has a national imperative to place itself in the forefront of evolving technologies. These different cultural visions of science and technology in Japan and in the United States have a profound influence on the course of technological innovation in the field of advanced materials. In America our national laboratories are mainly centers of science; in Japan the clear objective of the national laboratories is technological advancement.

Having seen a rough equality in the creativity and inventiveness in Japan and the United States, we turned to the question of transferring inventiveness into commercial innovation. The Japanese cultural mindset of "learning by doing" as compared to the American mindset of "learning from principles" has proved to have a profound influence on technological innovation. It has led to the Japanese accepting, even enthusing about, incremental innovations which have a large cumulative effect. This is in contrast with an American predilection for home grown breakthroughs. The Japanese mindset has also led to a willingness to undertake the manufacture of advanced materials for insignificant markets as a way of learning, with confidence that as learning proceeds and costs and quality improve, markets will develop.

A second profound cultural difference that permeates the mode of technological innovation is the strong American emphasis on individual achievement vs. the strong Japanese emphasis on group achievement. Japanese groups are interdisciplinary and consist of Ph.D.'s mixed together with technicians to provide a broad array of interactive experience and approaches toward problem solutions. This has been commented on by many observers, as has the difference in the Japanese system of lifetime employment and promotion based mostly on seniority as compared with the American system of contract employment, frequent job changes, and promotion based on individual accomplishments. With regard to innovation, an important consequence of these national characteristics is immensely more effective interdisciplinary, intracompany, and interorganizational networking by the Japanese. The number of visiting industry researchers working alongside the regular staff at national laboratories in Japan, for example, is astounding by American standards. Americans leaving their home organization find themselves departing from established career tracks and, in any event, their companies can never be sure that they will return. These same characteristics of individuality give rise to more intense specialization, stronger disciplinary boundaries, and effective networking *within a scientific field* in the United States, reinforcing and strengthening the effectiveness of the American science establishment, but isolating scientists from technological innovation. In Japan a group member in an industrial (or university or national laboratory) organization is encouraged to spend a year or more in a different organization, learning new skills and returning to a secure position able to enhance group performance. The Japanese social structure makes individual stars and Nobel prizes rare, but it much enhances technological and commercial innovation.

The strong "vertical" social organization in Japan that Chie Nakane identified as central to the family, village, and company in her classic 1970 book, *Japanese Society*, continues to exert a strong influence in many ways. It is a factor in the effort to develop consensus and harmony rather than confrontational decision-making. One result is that there is a strong input to decision-making in Japan coming up through the hierarchical organization, bringing more contributions of potentially creative and innovative ideas. The emphasis on consensus

has led a number of observers to quote a Japanese saying, "The nail standing out from the rest is the one hammered down," suggesting that creativity is hampered. In fact, Japanese managers appreciate this and have generally assured that there is time reserved for researchers' risky ideas to be accomplished as under-the-table activities which only surface when it becomes appropriate to solicit group consensus. Perhaps the most important aspect of vertical organization is the deep trusting relationships between suppliers and manufacturers and between manufacturers and customers. The most important feedback loops for technological innovation are from customers to manufacturers and manufacturers to suppliers. The strength of these feedback loops in Japan is a strong factor in the rapidity and effectiveness of Japanese technological innovation. Similar close interactions seem to be a characteristic of American military technological innovation.

The examples of invention, nascent industry, and infant industry that were the focus of our discussions all converged on the realization that technological innovation is not an event, but rather a long-term process. Japanese corporations have a focus on market share rather than short term profits which gives them a greater continuity of effort, which, in turn, is reinforced by employment practices and multidisciplinary group efforts. Some of this has been attributed to lower costs of capital, but that can hardly explain the Japanese predilection for four to five year funding of development programs as compared to the normal one year period (subject to renewal) common in the United States. Single year funding emphasizes rapid results independent of any costs of capital (it even leads to proposals being written for work already done so as to guarantee results.)

Policy implications were mentioned by some participants but were not the subject of much discussion or debate. However, it must be clear that the effects of an American culture so strongly ingrained with the importance of science that "scientific literacy" has become a buzzword for our educational requirements, with little or no consideration of engineering and technology, are substantial. Similarly, the Japanese immersion in the faith that technological innovation is the decisive factor shaping the future can hardly be ignored.

Finally, these experimental discussions made clear that there is a strong opportunity for a new anthropology of technology. Technological innovation is an activity, a process, involving social organization and human behavior, elements equally, if not more, important than technical considerations. This conference and the approach toward thinking about technological innovation must be seen as the initial often uncertain beginnings of a process; however, several caveats must be heeded before making too much of any conclusions. First, all the discussions were between and focused on a particular age group. Second, technological innovation in advanced materials seems to be quite different than innovations in medicine, biotechnology, and some other fields. Third, we have not had the depth of discussions of technological innovation by the American military that their success would seem to warrant. Most important, the development of rapid transportation, international television, telephone and fax machines, and the globalization of science, industry, and technology all combine to produce a breathtaking rate of change in all aspects of the industrialized world.

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STS RELATED EDUCATION IN CHINA

In China, educators have paid increasing attention to STS issues since the mid-1970s. After the end of the "Great Cultural Revolution" (1976), China has been confronted by the important problem of raising the level of science and technology as fast as possible. In this political and social setting, Chinese scholars have become increasingly interested in such problems as the nature of science and technology, their position and role in society, the pattern of their development, and global questions regarding environmental pollution, energy crises, population growth, etc. Philosophy and sociology of science and technology, management of research and development, science and technology policy studies, and history of science and technology have occupied an unexpectedly important position in the sphere of learning since 1976. In this sense then, STS education also began to flourish.

Toward the end of the 1970s, the Chinese Society for History of Science and Technology resumed its academic activities. At several National Congresses many scholars have discussed problems concerning the philosophy of science and technology, especially the definition of science and technology, and the patterns or laws of scientific and technological development.

The Chinese Society for Dialectics of Nature (Philosophy of Nature, Science and Technology), CSDN (PNST), which is to some extent similar to the National Association of STS in the United States, was formally founded in 1981. It holds membership in the China Association for Science and Technology. It is a non-governmental academic society composed of Chinese scholars in the field of mathematics; natural, technological, and social sciences; and philosophy including logic and ethics. More than 10 affiliated specialty committees have been set up, including Committees on Philosophy of Science, Philosophy of Technology, Philosophy of Astronomy, Philosophy of Medicine, Education, etc. CSDN (PNST) organizes domestic and international academic exchanges; supervises the publication of periodicals; promotes the study of philosophy of nature, science, and technology; provides advisory services; and teaches and disseminates academic research results. So far CSDN (PNST) has held more than 60 National Congresses on philosophy of nature, science, and technology. Next year an international congress on philosophy of science and an international seminar about philosophy of technology and STS will be held in Beijing.

In 1979, in order to develop undergraduate STS education, the Chinese Ministry of Education organized a number of experts to write a textbook, *Teaching Materials on Dialectics of Nature*, and a series of monographs. "Dialectics of Nature" is a required course for graduate students and an elective course for senior undergraduate students. In addition, there are also many elective courses about philosophy of nature, science and technology, history of science and technology, methodology of science and technology, etc. One of the monographs mentioned above, *Some Dialectic Content in Engineering and Technology* was written by scholars of Huazhong University of Science and Technology. This first monograph in the field of philosophy of technology in China has had a great impact on subsequent Chinese study and teaching of philosophy of technology. In China more than 3000 professionals are teaching and studying in the field of philosophy of nature, science and technology, and history of science and technology.

The Research Division of Dialectics of Nature, at the Institute of Philosophy of the Chinese Academy of Social Sciences, is the research center for dialectics of nature in China. The *Encyclopedia of Dialectics of Nature* compiled mainly by the Research Division will play an important role in Chinese STS education.

The primary objectives of STS education in China are: 1) to unite scientists and philosophers of nature, science, and technology in approaching the ontological, epistemological, methodological, logical and ethical problems in modern science; 2) to increase awareness and knowledge among all citizens of the nature of science and technology, and of their impacts on society; and 3) to increase an awareness among scientists and engineers of their work as social processes.

Yin Deng-xiang
Chinese Academy of Social Sciences

STS ACTIVITIES IN JAPAN

Since the pre-war period there has been a Marxist approach toward the history of science and technology in Japan. The list below spotlights ongoing current STS projects in Japan.

STS CENTER, founded in 1990, is part of the Research Institute of International Management at the Kanagawa University, 2946 Tsuchiya, Hiratsuka-city, Kanagawa-ken 259-12, Japan. Directed by Professors Shigeru Nakayama and Keiichi Tsuneishi.

Beside occasional lectures, the STS Center is attempting to act as a bridge between the STS community in the Western world and the non-English speaking, non-Western community, particularly Japan, by editing a *STS Directory*.

SCIENCE AND SOCIETY FORUM, supported by the Toyota Foundation.

Besides occasional lectures, the Science and Society Forum mainly sponsors group research on Japanese Science, Technology and Society in Postwar Japan. S. Nakayama has written a preview entitled *Science, Technology and Society in Postwar Japan*, published by Kegan Paul International. A four-volume, Japanese edition is scheduled to appear in 1992, published by Gakuyo Shobo.

STS NETWORK JAPAN, founded in March 1990, is located at the Department of Ethics of Science and Technology, RCAST, Research Center for Advanced Science and Technology, 4-6-1, University of Tokyo, Komaba, Meguro, 153 Japan. Director: Mr. Hideto Nakajima.

The STS Network Japan was established to promote Japanese STS research and education. More than 120 members are registered for the mailing list of its bi-monthly *Newsletter*. Members are mainly professors, graduate students, and high school teachers.

The Network defines STS as "the humanistic and sociological studies and education of the social aspects of science and technology." Its main activity thus far has been restricted to planning symposia to promote STS Studies. The proceedings of three symposia and Newsletters are available as a "Yearbook of 1990." Now the Network is trying to get into the next phase of its activity. The first step was a program entitled "The First STS Summer School" held at Nikko in July 1991. The second is a project to develop Japanese textbooks and educational modules for STS Studies like SISCON and SATIS. All of these are fortunately supported partly by the Earth Environment Foundation Japan and partly by a fund of the Japanese Ministry of Education. STS Network Japan has recently opened a computer communication network called STS NET on Nifty-Serve, one of the Japanese big commercial networks (accessible through Compu-Serve). It is expected that STS Network Japan will become one of the main institutions, cooperating with the STS Center of Kanagawa University.

JAPAN ASSOCIATION FOR SCIENCE, TECHNOLOGY AND SOCIETY, founded in 1978. Director: Mr. Miwao Matsumoto, Faculty of Economics, Josai University, 1-1 Keyakidai, Sakado-shi, Saitama, 350-02 Japan.

Japanese sociologists and historians of science established the Association. Colloquia have been held monthly inviting foreign as well as Japanese scholars. A STS session was also held at the annual meeting of the Japan Sociological Society last year.

Shigeru Nakayama
Kanagawa University

OPEN FORUM

CONFERENCE ANNOUNCEMENT

Tradition, Transmission, and Transformation: Ancient Mathematics in its Islamic and Occidental Context

A symposium on the history of medieval Islamic and Occidental mathematics will be held at the University of Oklahoma on March 6-7, 1992. Participants will include: J. L. Berggren (Dept. of Mathematics and Statistics, Simon Fraser University), Sonja Brentjes (Karl-Sudhoff-Institut, Karl Marx Universität, Leipzig), Menso Folkerts (Institut für Geschichte der Naturwissenschaften der Universität München), Jan P. Hogendijk (Mathematisch Institut, Rijksuniversiteit te Utrecht), A. G. Molland (Dept. of History, King's College, University of Aberdeen), Warren Van Egmond (University Honors College, Arizona State Univ.). For information concerning the symposium, contact: Professor Steven J. Livesey, Dept. of the History of Science, the University of Oklahoma, 601 Elm, Room 622, Norman, Oklahoma, 73019. Phone: [405] 325-2213; FAX: [405] 325-5068; E-mail: Bitnet AA9214@UOKMVSA.

GRANT ANNOUNCEMENT

Grants for Travel and Research at the Rockefeller Archive Center

The Rockefeller Archive Center, a division of The Rockefeller University, invites applications for its program of Grants for Travel and Research at the Rockefeller Archive Center for 1992. The competitive program makes grants of up to $1,500 to researchers in any discipline, usually graduate students or post-doctoral scholars, who are engaged in research that requires use of the collections at the Center, which include the records of the Rockefeller family, the Rockefeller Foundation, the Rockefeller University, and other philanthropic organizations and associated individuals. The deadline for applications is December 31, 1991; grant recipients will be announced in March. Inquiries about the program and requests for applications should be addressed to Darwin H. Stapleton, Director, Rockefeller Archive Center, 15 Dayton Ave., North Tarrytown, N.Y. 10591-1598.

CALL FOR JOURNAL PAPERS

Knowledge: Creation, Diffusion, Utilization, published by SAGE, and edited by Marcel C. LaFollette (George Washington University), is an international, interdisciplinary social science journal that examines the nature of expertise and the translation of knowledge into practice and policy. The editor is actively seeking articles on: issues of current controversy (e.g., privacy, censorship), examined from a rigorous social science perspective; the changing nature of ownership of intellectual property in the natural and social sciences; the implications of research and education computer networking on the use of scientific and technical knowledge; mass media use of experts and expertise; issues related to the private and public management of intellectual property; the relationship between expert evaluations and public needs, including the influence of government and private organizations on evaluation outcomes; developments in the nature of knowledge creation and utilization and their effects on consumption patterns; the use of experts and expert knowledge in political decision making; and the boundaries between "private" and "public" information. Submit manuscripts in triplicate to: Dr. Marcel C. LaFollette, *Knowledge*, Center for International Science & Technology Policy, The George Washington University, 2130 H St., N.W., Suite 714, Washington, D.C. 20052; [202] 994-6450.

OPPORTUNITIES

Job Openings

■ **The Division of Comparative Studies at Ohio State University** (pending final approval) invites applications and nominations for a tenure-eligible position at the level of assistant professor in Values, Science, and Technology, to begin in September 1992. Research field open. Teaching duties may include courses on "Science and Technology in Global Perspective," as well as such graduate-level courses as "Politics of Knowledge," "Tradition and Modernity, and "Theory and Practice of Comparative Study." Participation in course and program development is also expected. The VST Program is located in an academic unit dedicated to the interdisciplinary and cross-cultural study of knowledge. Other components of the Division include Comparative Literature/Folklore and Religious Studies. There are regular opportunities for interaction with faculty from diverse fields. Ph.D required and evidence of excellence in scholarship and teaching required. Women and minorities are encouraged to apply. Send letter of application and current vita to Chair, Division of Comparative Studies, The Ohio State University, 230 West 17th Ave., Columbus, OH 43210-1311. AA/EOE employer. The deadline for application is October 31, 1991.

■ **The History Department of the University of Delaware** is seeking a historian of technology and industrial America, tenure or tenure-track, to be appointed at the Assistant or Associate Professor level. Candidates having an interest in broad social and cultural aspects of the field are especially encouraged to apply, as are those with secondary research interests and teaching skills in business or economic history. The successful applicant will be expected to teach the survey course in U.S. history as well as advanced undergraduate courses in the area of specialty. He or she will also be expected to offer graduate seminars and to participate in the activities of the Hagley Program, a graduate program focusing on the history of industrialization broadly defined, which is sponsored by the University of Delaware and the Hagley Museum and Library. Salary commensurate with rank and experience. Send a letter of application, a c.v., and three letters of reference to Professor George Basalla, chair of the search committee, Department of History, University of Delaware, Newark, DE 19716. The application deadline is November 1, 1991. The university is an Equal Opportunity Employer, which encourages applications for minority group members and women.

■ **The Program in Science-Technology Studies at Colby College** seeks a one-year sabbatical replacement for 1992-1993 (pending administrative approval). The program provides students from all majors with historical, philosophical, and sociological perspectives on the human dimensions of science and technology. A minor and major are offered. Responsibilities include teaching five courses, including two required courses and several electives, advising students, and convening a colloquium series. Candidates with Ph.D.s in such fields as history or sociology of science and/or technology are strongly preferred. Colby is a highly selective liberal arts college in Maine. The college's facilities and collegial atmosphere are superb. To apply, please send a letter of application and vita to James R. Fleming, Program Director, Science-Technology Studies, Colby College, Waterville, ME 04901. Review of applications will begin February 1, 1992. Colby encourages applications from minorities and women--AA/EOE.

■ **The Program in Science, Technology, and Society and the Anthropology/Archaeology Program at MIT** invite applications for two positions, one senior and one junior, in the social and cultural study of science and/or technology. Candidates for both positions should expect to play an active role in the Ph.D. Program in the History and Social Study of Science and Technology. The senior position will be located in the Program in Science, Technology, and Society. The junior position will be a joint position in the Anthropology/Archaeology Program and the Program in Science, Technology, and Society. Candidates for this joint position should hold a doctorate in Anthropology. Research and teaching interests should focus on science and technology in advanced industrial societies; interest in the anthropology of development is also encouraged. MIT is an Equal Opportunity and Affirmative Action employer and strongly encourages the applications of women and members of minority groups. Nominations and applications, with a complete resume and three letters of recommendation, should be sent by December 11, 1991, to Professor Kenneth Keniston, STS Program, E51-110, MIT, Cambridge, MA 02139.

Forthcoming Meetings and Conferences

October 31-Nov. 3, 1991. *Critical Problems and Research Frontiers in History of Science and Technology.* Society for the History of Technology and History of Science Society, Joint Annual Meeting, Madison, WI. Contact: SHOT Program Chair--Deborah Fitzgerald, 1225 Orchard Drive, Ames, IA 50010; [515] 232-5809 or HSS Program Chairs--Albert Moyer and Richard Hirsh, Dept. of History, Virginia Tech., Blacksburg, VA 24061-0017; Bitnet: AEMOYER@VTVM1 or RICHARDS@VTVM1.

November 13-16, 1991. *Society for Social Studies of Science,* Annual Meeting, Cambridge, Mass. Contact: Program Chair, Ellsworth Fuhrman, Science Studies Center, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0247; [703] 231-7687; email: FUHRMAN@VTVM1.BITNET.

November 15-16, 1991. *Misconduct in Science--Recurring Issues, Fresh Perspectives*, Cambridge, Mass. Sponsored by The American Association for the Advancement of Science, American Bar Association National Conference of Lawyers and Scientists, and the Office of Scientific Integrity Review, U.S. Dept. of Health and Human Services. Contact: Deborah Runkle, Directorate for Science and Policy Programs, AAAS, 1333 H St., N.W., Washington, D.C. 20005; [202] 326-6794.

November 16-18, 1991. *Global Change and the Human Prospect.* Washington, D.C. Sponsored by Sigma Xi, The Scientific Research Society. Contact: Sigma Xi, P.O. Box 13975, Research Triangle Park, NC 27709; [919] 549-4691.

January 12-16, 1992. *III CLAHCT--Third Latin American Congress of the History of Science and Technology, Mexico City.* General theme: America in the formation of a new world: 500 years of scientific exchange. Contact: Comité Organizador III CLAHCT, Arpartado postal 21-873, 04000, México, D.F., Mexico.

February 6-9, 1992. *7th Annual Technology Literacy Conference,* National Association for Science, Technology and Society Annual Meeting, Washington, DC. Session/paper proposals due by October 1, 1991. Contact NASTS Headquarters, 133 Willard Building, Pennsylvania State University, University Park, PA 16802; Phone: [814] 865-9951; Fax: [814] 865-3047.

March 16-18, 1992. *Stability and change in Nature: Ecological and Cultural Dimensions.* Budapest, Hungary. Sponsored by International Forum for Biophilosophy, Hungarian Academy of Sciences, and Sigma Xi, The Scientific Research Society. (Follow-up to *Global Change and the Human Prospect Conference*, November 16-18, 1991 above). 3 copies of paper proposal abstracts limited to 500 words in English by October 18, 1991, should be submitted to Guido Van Steendam, IFB, Craenendonck 15, B-3000 Leuven, Belgium.

May 2-3, 1992. *DIAC-92--Directions and Implications of Advanced Computing,* Berkeley, Calif. 4th DIAC Symposium sponsored by the Computer Professionals for Social Responsibility. Paper proposals (4 copies) due by November 1, 1991. Contact: Program Chair: Douglas Schuler, 2202 N. 41st St., Seattle, WA 98103; [206] 632-1659 (home); [206] 865-3832 (work), EMAIL: dschuler@june.cs.washington.edu.

August 12-15, 1992. *4S/EASST,* Gothenburg, Sweden. The Society for Social Studies of Science annual meeting will be held jointly with the European Association for the Study of Science and Technology. Session proposals due by October 31, 1991; paper proposals due by January 31, 1992. Contact: John Hultburg, Center for Science Studies, Univ. of Gothenburg, S-41298 Gothenburg, Sweden. Phone: 46-31-631929; Fax: 46-31-634723.

August 16-21, 1992. *Society for the History of Technology*, Annual Meeting, Uppsala University, Sweden. Paper proposals due by October 1, 1991. Contact: Håkon With Andersen, Center for Technology and Society, Univ. of Trondheim at Lade, N-7055 Dragvoll, Norway. Phone: 47-7-591789; Fax: 47-7-591327; Bitnet: H_Andersen@AVH.UNIT.UNINETT. For conference information contact: Uppsala Turist & Kongress, "SHOT," Box 216, S-751 04 Uppsala, Sweden. Fax: 46-18-132895.

January 3-8, 1993. *Science Education in Developing Countries: From Theory to Practice.* Jerusalem, Israel. Contact: Avi Hofstein, Dept. of Science Teaching, The Weizmann Institute of Science, Rehovot 76100, Israel; Phone: 972-8-342278; Fax: 972-8-344115; email: NTHOFSTN@WEIZMANN.

Readings That Help

This section of the *STS Newsletter* is meant to guide the reader to books or articles that someone recommended to me because they are useful, provocative, or enjoyable--at best, all three. Suggestions of other materials to be reviewed would be most welcome, with or without comments. But I hope you will feel free to comment on my opinions as well.

Barrett Hazeltine
Associate Dean of Engineering, Brown University,
Providence, RI 02912

[Editor's Note: This column contributed by Barrett Hazeltine, Associate Dean of Engineering at Brown University, was formerly published in the Weaver. As announced in our last issue, the Weaver has now ceased independent publication and joined forces with the STS Newsletter. Barrett has graciously agreed to continue contributing this column and welcomes responses to his reviews and suggestions of useful works for inclusion. SHC]

BRENNAN, RICHARD P. *LEVITATING TRAINS AND KAMIKAZE GENES. TECHNOLOGICAL LITERACY FOR THE 1990S.* NEW YORK, N.Y.: JOHN WILEY & SONS, 1990. 288 P. PAPER: $18.95.

To paraphrase the author, "If you, like many others, have been faking it--pretending to know all about technology--this is the book for you." The scope is wide: space exploration, genetic engineering, computers, superconductivity, and five other chapters. The writing is lively. The book begins with a self test of technological literacy, and each chapter concludes with a list of key concepts. From the medicine chapter, for example, the reader is told about imaging technologies--CAT, sonography, DSA, PET, and MRI, about defibrollators and pacemakers, balloon angioplasty, and hemopumps, about tissue transplants, about lifestyle assessment programs, and presymptomatic diagnosis, and several other topics--in 27 pages. It is difficult to predict what someone will take away from this presentation, probably what the words mean and a desire to learn more of the concepts. In regard to the tradeoff between accessibility and validity, I think the book simplifies too much, losing essentials, but perhaps the intended reader will find the balance just right.

HARDISON, O. B., JR. *DISAPPEARING THROUGH THE SKYLIGHT.* NEW YORK, N.Y.: PENGUIN, 1990. 416 P. PAPER: $12.95. BIBLIO.

What is disappearing through the skylight?--culture, the way we look at nature and history, forms of art, music and literature, our perceptions of the uniqueness of the human species. Why the disappearance? --science and technology, that now appear to be able to accomplish the things--composing poetry or being self-conscious, for example--that previously only people could do. Why do we need history or nature if machines can do everything so well? For that matter are people about to be made obsolete by silicon chips, tied to some sort of device? Much of the book is about computers--can they think and how could we tell? The examples run from fractals to electronic music. Architecture also gets attention, with its roots in both the ethos and the artifacts of technology. The range of subjects is remarkably wide. From my own background as an engineer I was most convinced by the cultural arguments rather than by the science and technology, but I felt I learned a great deal analyzing my disagreements.

HUGHES, THOMAS. *AMERICAN GENESIS.* NEW YORK, N. Y.: VIKING, 1990. 448 P. PAPER: $10.95.

Inventors, industrial scientists, engineering and system builders have been, it is argued, the builders of modern America. Technological history is mainstream American history. This history begins with Edison and Elmer Sperry--independent inventors, lonely gladiators, represented in our day perhaps by computer buffs. The successful inventions created whole new systems--Edison's electric lamp was part of a system of generation, distribution, and metering. The electric utility of Samuel Insull is a system. The military/industrial complex that builds modern weapons, such as Admiral Rickover's nuclear submarines, is another. Technological change is both the radical inventions associated with independent inventors and the many small improvements to existing systems, these innovations usually coming from industrial laboratories with less flamboyant

designers. In the 1920s, U.S. technology caught the imagination of Europeans--Russians and Germans, in particular. It also captured the imaginations of painters and architects. Enthusiasm for technology has waned in recent years, and the technology itself has failed conspicuously; the history ends with Three Mile Island and the Challenger disaster. A broad canvas, an emphasis on people, and insight into the influences between technology and society make this readable and very worthwhile.

PETROSKI, HENRY. *THE PENCIL - A HISTORY OF DESIGN AND CIRCUMSTANCE.* NEW YORK, N. Y.: KNOPF, 1990. HARDCOVER: $25.00.

Wood cased graphite pencils were known in 1683. Recent annual worldwide production is about 14 billion despite the presence of ball point pens, typewriters, and word processors. Henry David Thoreau's father was a significant factor in the U.S. pencil business before retreating before imported German pencils. Early quality pencils used single pieces of graphite from a particular mine in Borrowdale, England, but perhaps the most important invention in the field was by a French engineer who, driven by shortages during an English-French war, invented a process of making leads by firing a mixture of finely powdered graphite and clay. The center of manufacturing passed to Germany, and then in the middle of the nineteenth century to the United States, where the market was bigger and new technology more accepted. The present day double cutter pencil sharpener was an established product in the 1920s. Erasers were put on pencils in the 1860s but were not really accepted for another 60 years. A parallel theme is how engineering is really done: "...the pencil and its history seriously instruct us by analogy and suggestion in the ways of engineers and engineering." Pencil making is part craft and part science. Economic factors--availability of raw materials and tariff barriers--are determinants of design. Companies that do not innovate fail. This is a book that many will enjoy and profit from.

STOLL, CLIFFORD. *THE CUCKOO'S EGG: INSIDE THE WORLD OF COMPUTER ESPIONAGE.* NEW YORK, N.Y.: DOUBLEDAY. 1989. HARDCOVER: $19.95.

Clifford Stoll was an astronomer/computer wizard who was made a computer systems manager in one of the Berkeley laboratories when his grant ran out. Because of a 75 cent accounting shortfall, he detected an intruder dialing into the system. It took ten months of serious detective work--the subject of the book--to find the intruder. The story is at least as engrossing as *Hunt for Red October* and is true. The reader learns about the technology of computer networks and of the high speed data links. Two sub-themes repeat themselves. Neither military nor civilian agencies are prepared to deal with computer crime. Stoll is sent from the FBI to NSA to the CIA to the Air Force and around the circle again--his problem does not fit into anyone's bailiwick. The second sub-theme is Stoll's realization as to why getting into someone else's computer files is wrong, even if, as his Berkeley friends chide him, the files are unclassified military information. An exciting story, much worthwhile information, a real concern for moral issues, and Stoll comes through as a very likeable person.

VINCENTE, WALTER G. *WHAT ENGINEERS KNOW AND HOW THEY KNOW IT: ANALYTICAL STUDIES FOR AERONAUTICAL HISTORY.* BALTIMORE, MD.: JOHNS HOPKINS UNIVER. PRESS, 1990. 257 P. HARDCOVER: $45.00.

A subtitle might be "What Engineers Do." The chapters are of two kinds: cases in the history of aeronautical engineering and the epistemology of engineering. The five cases deal with airfoils, control and stability, a theoretical design tool, propeller testing, and flush riveting. The issue in the airfoil case is how engineers react to incomplete and uncertain knowledge--an airfoil design by a maverick tested better than expected. Stability relates to how a flying aircraft responds to disturbances--does it tend to return to its previous path? Control relates to how rapidly a pilot can change direction. In aircraft design a tradeoff is made between stability and control. The case deals with how to couch these concepts into quantitative design criterion. The theoretical design concept discussed is control-volume analysis used widely by engineers but hardly ever by physicists. The issue in the propeller design case is systematic data gathering--parameter variation. The solution to the problem of getting rivet heads out of the airstream illustrates the craft of engineering. Engineering design knowledge is presented as being in six categories: fundamental design concepts, criteria and specifications, theoretical tools, quantitative data, practical considerations, design instrumentalities. Extensive observations are made about the difference between engineering and science. An added bonus are notes about how airplanes fly. This is a sophisticated, scholarly book, certainly of great value to social scientists and anybody else, including engineers, who are concerned with how engineering is done. Some parts, especially those on the history and the design methodology, would be inspirational and very useful to engineering students.

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Science, Technology & Society

Curriculum Newsletter of the Lehigh University STS Program & Technology Studies Resource Center

Editor: Stephen H. Cutcliffe

No. 86/87, November/December 1991
ISSN: 0275-8075

STS, WOMEN'S STUDIES, AND THE TRANSFORMATION OF THE UNDERGRADUATE CURRICULUM

There has been considerable rhetoric in recent years regarding the need to reform the undergraduate curriculum so that it will reflect current realities of our technological society--realities which involve rapid information gathering and dissemination, extensive intercultural contact, and the interrelatedness of politics, economics, and social and technological development.

Our traditional ways of systematizing knowledge have appeared to us for a while now to present problems of narrowing perspective and isolating variables to the detriment of contextual considerations. The language specialists employed to clarify and delineate concepts within their own fields--and indeed to carve out these fields as legitimate disciplines in the first place--have created jargon barriers which hinder communication between disciplines at precisely a time when integration of information is becoming more and more necessary.

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We are faced with the intellectual and psychological dissatisfaction of living in a world where the assimilation of great quantities of information gives rise to increasing specialization and theory development within narrowed parameters while assessment of the appropriate use of the resultant knowledge within human society requires a broad, holistic perspective and multifaceted analysis of which we are less and less capable. The resulting frustration has given rise, in the last half of the twentieth century, to educational reform movements calling for "relevance" in education and a reappraisal of our traditional tests of objective "truth." The 1960s, as is well known, was a time of particularly heightened awareness of the need for educational institutions to become more socially responsible. This effort was spurred by social reform movements outside of academia, such as civil rights, environmental accountability, and the anti-war movement.

It was during this period that both women's studies and STS gained a foothold on American

college campuses. The social protest movements (of women's liberation in the first case and concern over misuse of technology in the second) spawned the initial interest in these subjects and thus provided justification for their study within colleges and universities. The ideological origins and the continuing ideological component of both STS and women's studies not only provide an identifiable focus for research within each field, but also link the two fields by their shared commitment to social change. They create opportunities for collaboration that can be significant in promoting reform of general undergraduate education, particularly in the redesign of core requirements.

The purpose of this paper is to review the conceptual foundations of the two fields, to articulate the similarities between them, and to explore the ramifications of collaboration between women's studies and STS studies researchers both for enhancement of their own disciplines and of the promotion of broader curricular reform in American education.

The relevance of the women's liberation movement to women's studies is commonly noted by feminist writers. Helen Weinreich-Haste (1986:119), drawing upon the historical record of feminism, points out that "feminism, at various points in history when it has emerged as a dominant force in social thought, has never been confined solely to the demand for legal changes; it has always been associated with efforts to change the conception of sex roles and sex differences." This latter effort has prompted a considerable degree of scholarly research, including (and this is of particular interest to us) a feminist critique of science. In *Feminist Scholarship: Kindling in the Groves of Academe*, the authors note how the "connection of the women's liberation movement has provided a foundation for shared perspectives and ideas" while the "analytic concepts of oppression and liberation have been especially important as organizing principles for the feminist scholar" (DuBois et al., 1985:199). They go on to say that while there are many varieties of feminist scholarship, what gives coherence to the field is its link to the more general feminist movement.

The authors make a careful distinction between the ideological focus, which unites women's studies research, and the shared-subject-matter focus, which provides coherence to other interdisciplinary fields, such as American or urban studies. "It is not just the subject of women that unifies feminist scholarship," they explain. "Rather the politics of modern feminism provides women's studies with an additional way to bring together diverse scholarship into a unified endeavor" (DuBois et al., 1985:199).

STS, as a subject of study, shares this unique situation of having its origins in a social movement arising outside of academia. George Bugliarello (1986), speaking of the conceptual foundations of STS, notes how one can view STS as both an ideology and a discipline. "As an ideology," he writes, "its aim is to shape the relationship between technology and the rest of society according to certain beliefs as to the nature and purpose of technology." As a discipline, the objectives are to "understand the interactions between a technological system and the social environment both inside and outside of the system" and to "shape the interactions among social systems to respond to specific goals." Indeed, the very commitment of the National Association of Science, Technology and Society (NASTS) to maintain strong ties with those directly involved in reform efforts, such as environmentalism, and to represent itself as an umbrella organization in which a wide variety of voices can confer together to further the cause of scientific and technological literacy, indicates that this link to its social reform origins is still very much alive.

Just as women's studies researchers attempt to uncover the cultural biases which are responsible for unequal treatment of women with the hope of

fostering social change, so STS has a mission to fulfill in identifying the operative values which determine the course of technological activity (Goldman, 1986:10), thus promoting better understanding and the hope of eliciting more intelligent policy decisions.

As Langdon Winner puts it, the STS field of inquiry "occupies an enormous void, one created by a society that long ago committed itself to forge ahead full bore with scientific and technological advance, but never to forge ahead in developing the critical self-reflection such change seems to require" (Winner, 1986:7). Discussing current trends in STS scholarship, Stephen Cutcliffe (1989:23) maintains "...we are now beginning to move into a phase where STS may help to shape public response and involvement in decision making regarding scientific and technological change both by providing an awareness of the public's intimate involvement and by offering suggestions regarding the specific role that it has to play."

Both women's studies and STS studies have gone through several developmental stages (some quite parallel) to reach their present level of intellectual sophistication.

Chart 1 highlights the stages and the parallels.

CHART 1
PARALLELS IN INTELLECTUAL DEVELOPMENT OF STS AND WOMEN'S STUDIES

WOMEN'S STUDIES*	STS STUDIES
Stage 1: (predisciplinary stage) Identifying historical contributions of women	Stage 1: (predisciplinary stage) First discussions of science and technology as social enterprises
Stage 2: (critical stage) Investigating women as a disadvantaged group; criticism of traditional paradigms; women's studies programs established	Stage 2: (critical stage) Call for social responsibility of scientists/engineers; criticism of technology; STS programs established
Stage 3: (analytical stage) Analysis of diversities; diversities among women; discussion of the variety of female experience	Stage 3: (analytical stage) Analysis of cultural, class, racial diversities in assimilation of science and technology; role of values
Stage 4: (integrative stage) Gender as a category of analysis; call for alterations of existing paradigms, integration of feminine perspectives, transformation of curricula	Stage 4: (integrative stage) Call for scientific literacy; promotion of public awareness of S/T/S interrelationships; call for curricular reform

*After Schuster, M.R. and S. R. Van Dyne, (1985). Stages of curriculum transformation. In Schuster, M. R. and S. R. Van Dyne, eds., *Women's Place in the Academy: Transforming the Liberal Arts Curriculum* (pp. 13-29). Totowa, NJ: Rowman & Allanheld.

Initially (Stage 1), the emphasis in the feminist movement was to identify the historical contributions of women as a corrective to the notion that women's activities were of limited significance and therefore unworthy of study. The next stage (Stage 2), which occurred when formal women's studies programs were first organized in higher education, was to investigate women as a disadvantaged group, to determine the social forces which led to devaluing women's roles and viewing females as subordinate. As women's studies developed (Stage 3), researchers turned inward to analyze differences among groups of women (with special attention to racial and class diversities) in order to articulate more fully the variety of female experience. Currently (Stage 4), much work in women's studies involves using gender as a category of analysis to challenge traditional paradigms in the various disciplines, and to cast doubt on the validity of such notions as historical periodization, behavioral norms, and the "objectivity" of the scientific method. The goals now are transformation and balance of the curriculum, rearticulation of paradigms, and integration of new knowledge.

STS studies within academia has gone through a somewhat similar metamorphosis. The earliest work first addressed the idea that science and technology were social enterprises. The anti-technological, anti-establishment focus of the 1960s prompted a renewed movement directed toward sensitizing scientists and engineers first to the social (Stage 1) and then ethical implications (Stage 2) of their professional output. It was at this time that STS programs and courses began to be established. (This parallels events in women's studies at this same time. Then, women's studies programs and courses were first being established, and their focus, critical to the status quo, was to reveal how society at large had come to devalue women and to sensitize the scholarly community to the existence of biases and gaps in their own analyses.)

From this initial highly critical focus, STS studies then shifted (Stage 3) to an investigation of how a complex set of social values provide direction to scientific and technological research and influence how new discoveries and technological innovations are assimilated. As with women's studies, this inward-directed stage allowed for the exploration of cultural, class, racial, and gender diversities. In STS course work, this broader social-context analysis was aimed at all students, not just those involved in science and engineering.

More recently (Stage 4), STS has viewed its mission as one of conveying scientific and technological literacy to the general public, with the positive goal of creating a foundation for fuller integration of scientific and technological activity into the public consciousness--a foundation from which constructive dialogue and informed decision making can emerge. The "integrative" stage also parallels current directions in women's studies toward curriculum transformation.

The history of women's studies and STS reveals commonalities, then, in their ideological origins and patterns of development. Both fields now have attained relative success in becoming formalized as academic programs or departments on university and college campuses and in gaining credibility for their scholarly research. Sufficient scholarship has now been generated for us to look at the potential for intellectual linkages between women's studies and STS. Since the fields are both fairly new and since their methodologies and perceptual paradigms continue to undergo significant development, one must avoid speaking of either field as having achieved consensus regarding a core theory. However, it is possible to isolate several areas of identity in focus and approach where collaboration can be useful. These areas are outlined on Chart 2.

CHART 2

AREAS OF POTENTIAL COLLABORATION BETWEEN STS AND WOMEN'S STUDIES

FOSTERING HOLISTIC THINKING

INVESTIGATING THE ROLE OF VALUES

PROMOTING SOCIAL RESPONSIBILITY/RECOGNITION OF DIVERSITY

DEVELOPING INTERDISCIPLINARY METHODOLOGIES

DISCOVERING NEW SOURCE MATERIAL/NEW AVENUES FOR RESEARCH

First, there is an essentially holistic outlook pervading both fields. A holistic viewpoint is, indeed, the *raison d'etre* of STS--recognizing the ramifications of science and technology in their broadest social context is intrinsic to the STS mission. A holistic point of view is similarly emphasized in women's studies research, where contextual elements are seen to be important considerations when addressing issues of gender roles and gender differences. Holistic thinking has also been considered a central characteristic of women's ways of knowing (Rosser, 1990; Keller, 1983). Sue Rosser has found, for example, not only that women investigate problems of "more holistic, global scope than the more reduced and limited scale problems traditionally considered (by men)," but, "formulate hypotheses focusing on gender as a crucial part of the question being asked," use methods from a variety of fields or interdisciplinary approaches to problem solving, and develop theories "that are relational, interdependent, and multicausal rather than hierarchical, reductionistic, and dualistic" (Rosser, 1990: 44-45, 50).

Collaboration is possible here between STS and women's studies scholars in the general articulation of the variety of parameters in which discussions of the role of women and of science in society can take place. The holistic approach serves as a useful corrective to thinking in too limited, deterministic terms.

Second, both women's studies and STS researchers share an interest in investigating the influence of values on human behavior and theories about the natural world. For example, work has been published in each field highlighting the misconception of science as value-neutral, and pointing out the variety of ways in which the articulation of scientific hypothesis, experimental design, and interpretation of results are value-laden, and therefore non-objective. Similar arguments have been made with regard to the development and dissemination of technologies.

In STS the notion of the scientific and technological enterprise as value-laden is a benchmark of the discipline. Much contemporary research has investigated group dynamics within the scientific community to reveal how new discoveries are, in effect, screened through a filter of paradigmatic expectations and validated or rejected on the basis of predetermined procedural conventions. Likewise, the dissemination of new technologies is often related more to external economic and political agendas (or simply to an expectation of "technological progress") than to

any intrinsic unity of the technology itself. To explicate the science-technology-society relationships and interactions successfully involves developing an understanding of "what values are, how people come to hold them, and how values evolve" (Cutcliffe, 1989:25).

Several key works by feminist writers have investigated the ways in which values have historically influenced scientific and technological perceptions in specific areas and how these perceptions affect the social status of women. Carolyn Merchant's work, *The Death of Nature* (1980), traces the development of the notion of exploitation of nature in the mechanistic worldview of the seventeenth century, comparing it with the previous world order based on cooperation between humankind and nature, and relating it to the social sanctioning of the subordination of women. The work of Ruth Hubbard (1979) has revealed how closely the basic metaphors ("survival of the fittest," "competition," "ecological niche") and the assumptions of male dominance that Charles Darwin employed to articulate his theory of evolution and the associated theory of sexual selection reflect the Victorian social values of his day. Furthermore, these same value-laden and contingent theories of Darwin were later used to back up a variety of constructs of sociobiologists, resulting in descriptions of human sex roles and behaviors as innate and programmed into the genes (Hogsett and Rosser, 1983).

There is clearly opportunity for enhanced collaboration of STS researchers (particularly those competent in the history of science) and women's studies historians for the purpose of comparing findings on the role of values in the development of scientific and social explanations, investigating how individual scientific and technological innovations are perceived differently according to gender and race, and discussing the relevance of these findings to political and economic decision making.

Third, opportunities for collaboration between STS and women's studies scholars exist because of their mutual concern for promoting social responsibility and their recognition that diversity of perspective should be respected. Much work in women's studies illustrates the strong concern for social responsibility present among women, linking this to the female nurturing role. More specialized research specifically on professional interests of men and women scientists reveals consistently that the women scientists are "unwilling to undertake research likely to have applications of direct benefit to the military and more likely to propose hypotheses to explore problems of social concern" (Rosser, 1990:41). Rosser cites, as an example, the opposition of Lise Meitner, the physicist who first described nuclear fission, to the use of her discovery to make the atom bomb. As a scientist, Meitner not only refused to become involved in the development of the bomb, but also directed her efforts toward promoting international cooperation to prevent use of atomic weapons (Rosser, 1990:42). Research has shown that women characteristically attempt to exert "positive control over the practical uses of scientific discoveries to place science in its social context" (Rosser, 1990:53).

Initial work by feminist researchers seeking to distinguish female perspectives from those of the male population failed to address fully issues of racial and economic diversity among the populations studied. But today a great deal of work focuses on the differences among women. Increased collaboration between women's studies and African-American studies highlights this commitment to address issues of diversity. (See, for example, Margaret Andersen's essay, "Women's Studies/Black Studies: Learning From Our Common Pasts, Forging a Common Future" in Schuster and Van Dyne, 1985).

Interest in fostering social responsibility and recognition of diversity is central to STS studies too. From its inception, STS studies emphasized

the importance of citizen participation and the promotion of responsible uses of science and technology. With growing sophistication, today's STS researchers attempt to identify and articulate the variety of cultural responses to science and technology with the aim of deriving more appropriate mechanisms of public involvement in scientific and technological decision making.

Here is an area where the ideological missions of STS and women's studies intersect. If socially responsible use of science and technology is the goal, then STS researchers must address issues of diversity in perspective within, as well as across, population groups. Women's studies research into diversity among women can be particularly instructive here. As enhanced commitment to social responsibility can lead to corrective measures to combat gender inequalities, so this enhanced commitment can lead to appropriate public overseership of the scientific and technological enterprise.

Fourth, STS and women's studies can both benefit from ongoing attempts within each field to borrow methods and findings from traditional disciplines to structure and analyze their own research. Maintaining a broad interdisciplinary focus is difficult--in fact, it has been pointed out that due to this complexity, "recently feminist scholars have begun...to debate the virtues of integrating work from many disciplines versus conceiving of women's studies as a discipline in itself." And yet, "whatever shape the field of feminist scholarship eventually assumes, it will have been fed from many different disciplines" (DuBois, 1985:198). STS has been faced with a similar dilemma--how to gain acceptance within the academic community as a recognizable subject of study while maintaining its cross-disciplinary, inclusivist perspective. One way STS has looked for legitimation as a discipline is by attempting to articulate more clearly its conceptual foundations (Goldman, 1986:10), while calling for a synthesis of the methodologies and goals of the large number of existing disciplines having bearing on it (Bugliarello, 1986). By documenting the complexity of incorporating disparate methodologies while attempting to transcend the boundaries of traditional fields, STS and women's studies can educate each other as to how best to present themselves as viable disciplines in addition to perfecting their investigative procedures.

Fifth, the willingness of both STS and women's studies scholars to draw upon literature from an extremely wide range of sources and the success in opening up wholly new avenues of research have resulted in an increased potential for making novel correlations between events and for expanding the scope of both fields. An obvious example is the investigation of gender-specific technology, such as household technology and technologies of reproduction and child-rearing (Cowan, 1979, 1983, and Stanworth, 1987), which is of considerable use to those seeking to understand both the degree to which a given technology can affect society and how attitudes toward technology can differ between social groups within a single culture.

In her discussion of how women scientists' approach to investigation differs from the traditional (male-determined) norm, Sue Rosser notes that women expand their observations "beyond those traditionally carried out in scientific research to include various interactions, relationships, or events not seen or considered worthy of observation by traditional scientists operating from an androcentric perspective" (Rosser 1990:38). She cites the example of Ellen Swallow Richards, a chemist who became head of the Woman's Laboratory at MIT, whose focus on food product purity and air and water contamination laid the basis for the field of home economics.

For STS and women's studies researchers, the study of activist groups and their impact on society and policy making is of considerable value in drawing broader conclusions about how

concerns about science, technology, and women can become catalysts for social change. Bringing to light the contributions of women in the history of science, using documents heretofore little consulted, such as women's diaries and personal correspondence, popular magazines, and records of women's organizations, already has proved useful in re-evaluating the historical record relating to both science and women. In general, the broadening of research opportunities engendered by both women's studies and the study of STS is highly desirable and beneficial to the growth of each field.

An increased association between those engaged in women's studies and STS has an additional benefit beyond that which each field can gain in intellectual acumen. The strengthening of linkages between STS and women's studies can have practical value for curricular reform, with regard both to restructuring the undergraduate core curriculum and to improving science, mathematics, and engineering education.

The current calls for general reform in American undergraduate education are many, as is apparent from the number of reports on education generated by federally-funded agencies, private foundations, and educational institutions themselves. A primary target of reform efforts in higher education has been the reevaluation and restructuring of the undergraduate core curriculum. Approximately two-thirds of all the nation's colleges and universities either have recently reformed their undergraduate curriculum or are in the process of doing so. Increased cohesiveness of the curriculum and integration of the overall intellectual experience are the desired outcomes of this move to revamp core requirements.

An example of the specific pedagogical goals being emphasized by contemporary educational reformers is provided in the [*University of Maryland*] *College Park Plan for Undergraduate Education 1988*, the agenda for a reform effort now under way at that institution. The goals expressed in that document include "teaching students to extend principles and ideas to new situations, and to new groups of people," "providing students with a sense of identity and purpose, a concern for others, a sense of responsibility for the quality of life around them," "enlivening students to develop humane values, to celebrate tolerance and fairness, to contribute to the social conscience, to monitor and assess private and collective assumptions,...to become aware of the variety of ways of knowing, and to understand one's place in history and in the contemporary world" (*College Park Plan for Undergraduate Education* 1988:15). In essence, what is being sought is a multifaceted perspective grounded in a conscious analysis of values and an appreciation of the context in which ideas are born and events take place.

Much of the conceptual groundwork for undergraduate general education reform along the lines indicated above already has been laid by those scholars engaged in women's studies and STS over the last thirty years. Not only have the aspects of pedagogy desired for general curricular reform long been emphasized within STS and women's studies, but the commitment to interdisciplinarity evident in these two fields sets an example for students of how information and methodologies of several subject areas can be integrated. Likewise instructive is the ability of both STS and women's studies researchers to identify diversity of perspective within as well as across disciplines and to consider ideas generated outside of academia in their discussions. This flexible, fluid approach to studying a subject aids in breaking down the often ossified barriers between traditional academic fields and leads to an increased "connectedness" which enhances the undergraduate experience. Fostering such connectedness is, and should rightly be, the goal of general curricular reform.

A more tangible and immediate ramification

of improved linkages between STS and women's studies is the potential for reform of the science, mathematics, and engineering curricula, both in K-12 and in postsecondary education. The problem of making science, mathematics, and engineering fields attractive to women has been addressed extensively in recent literature. Task forces, pilot programs, and faculty sensitivity sessions have been implemented with the goal of improving classroom climate and permitting women to develop hands-on skills. Much has been written about the need to present science instruction to both sexes in a more meaningful way--to make it relevant to the lives of the students and to emphasize contextual elements.

Just as it has been a goal of many involved in women's studies and the feminist movement in general to improve science, technology, and math education for women, so scientific and technological literacy has been a major goal of STS, and the reform of curriculum to accomplish this goal has been well emphasized.

A significant amount of women's studies research has focused on how women learn, and particularly how they learn and react to science. Mary Field Belenkey (1986) distinguished five different perspectives from which women view reality and draw conclusions, suggesting that women are connected knowers uncomfortable with separate, procedural knowing skills. Nancy Chodorow's thesis is that gender-specific ways of knowing can be referred back to early child development, where females remain connected to their mothers, while boys strive for independence and separateness (Chodorow, 1978). Sue Rosser has outlined the ways men and women scientists differ in how they perceive a scientific problem, proceed in investigation, and formulate conclusions (Rosser, 1990). Such research is useful for the development of new teaching strategies in science, technology, and mathematics, and these strategies will become increasingly important as efforts to interest more women in science, math, and engineering careers become more intense.

The increased awareness of the social dimensions of scientific and technological discovery resulting from the work of STS researchers can also provide opportunities for reform in science teaching. A shift to discussion of more relevant issues and interjection of contextual information can enhance student understanding of a given scientific or technological subject. Making science more interesting and accessible increases student motivation and improves the chances for a student to feel comfortable and competent with the subject matter.

At the college level, women's studies and STS elective courses serve as useful adjuncts to required courses for science majors, by heightening awareness of gender biases and providing a corrective to too-rigid perceptions of science as a strictly logical, wholly objective process.

Enhanced collaboration between scholars in women's studies and STS studies can have far-reaching consequences. Both fields have developed to the point where collaboration is not only possible but especially advantageous. Fueled by their ideological missions, which inspire a strong desire for reform, and enabled by an ever-growing sophistication in research methodologies, which provides credibility and legitimacy to their programs and to the individuals who work within them, women's studies and STS can together create the meaningful strategies, sense of direction, and momentum necessary for substantive change in higher education.

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REFERENCES

Adams, J. (1986, February). One Peanut Butter Sandwich--Hold the Bread. *Science, Technology, and Society Curriculum Newsletter of the Lehigh University STS Program*, Number 52, pp. 2-8.

Belenkey, M. F., B. M. Clinchy, N. Goldberger, and J. M. Tarule, (1981). *Women's Ways of Knowing: The Development of Self, Body, and Mind*. NY: Basic Books.

Bugliarello, G. (1986, April). Socio-technology: The Quest for a New Discipline. *Science, Technology and Society Curriculum Newsletter of the Lehigh University STS Program*, Number 53, pp. 2-5.

Chodorow, N. (1978). *The Reproduction of Mothering: Psychoanalysis and the Sociology of Gender*. Berkeley, CA: University of California.

College Park Plan for Undergraduate Education 1988, University of Maryland College Park, approved by the Campus Senate, March 7, 1988.

Cowan, R. S. (1979). From Virginia Dare to Virginia Slims: Women and Technology in American Life. *Technology and Culture*, 20 (1), 51-63.

Cowan, R. S. (1983). *More Work for Mother: The Ironies of Household Technology*. NY: Basic Books.

Cutcliffe, S. H. (1989). Science, Technology, and Society: An Interdisciplinary Academic Field. National *Forum*, 69(2), 22-25.

DuBois, E. C., G. P. Kelly, E. L. Kennedy, C. W. Korsmeyer and L. S. Robinson. (1985). *Feminist Scholarship: Kindling in the Groves of Academe*, Urbana, IL: Univ. of Illinois.

Easlea, B. (1986). The Masculine Image of Science, With Special Reference to Physics: How Much Does Gender Really Matter? In J. Harding, ed., *Perspectives on Gender and Science* (pp. 132-58). London: Falmer Press.

Ekman, R. (1983). Women and the Changing Norms of Health and Disease. In M. Triplette, ed., *Women's Studies and the Curriculum: Proceedings of the Conference on "Scholars and Women," March 13-15, 1981* (pp. 77-86). Winston-Salem, NC: Salem College.

Goldman, S. L. (1986, April). The Quest for STS Studies. *Science, Technology and Society Curriculum Newsletter of the Lehigh University STS Program*, Number 53, pp. 8-11.

Hogsett, C. A. and S. V. Rosser (1983). Darwin and Sexism: Victorian Causes, Contemporary Effects. In M. Triplette, ed., *Women's Studies and the Curriculum: Proceedings of the Conference on "Scholars and Women," March 13-15, 1981* (pp. 67-76). Winston-Salem, NC: Salem College.

Hubbard, R. (1979). Have Only Men Evolved? In R. Hubbard, M. S. Henifin, and B. Fried, eds., *Women Look at Biology Looking at Women* (pp. 7-36). Cambridge, MA: Schenkman Publishing Co.

Keller, E. F. (1983). *A Feeling for the Organism: The Life and Work of Barbara McClintock*. NY: W. H. Freeman.

Keller, E. F. (1986). How Gender Matters: Or, Why It's So Hard for Us to Count Past Two. In J. Harding, ed., *Perspectives on Gender and Science* (pp. 168-83). London: Falmer Press.

Knapp, E. A. (1984, September). Liberal Arts Education for the 21st Century. *Science, Technology and Society Curriculum Newsletter of the Lehigh University STS Program*, Number 43, pp. 1-5.

Lerner, G. (1981). *Teaching Women's History*. Washington, D.C.: American Historical Association.

Longino, H. (1983). Scientific Objectivity and Feminist Theorizing. In M. Triplette, ed., *Women's Studies and the Curriculum: Proceedings of the Conference on "Scholars and Women," March 13-15, 1981* (pp. 33-42). Winston-Salem, NC: Salem College.

Merchant, C. (1980). *The Death of Nature: Women, Ecology, and the Scientific Revolution*. San Francisco, CA: Harper & Row.

Nielsen, J. McC. (1990). *Feminist Research Methods: Exemplary Readings in the Social Sciences*. Boulder, CO: Westview Press.

Rosser, S. (1990). *Female-Friendly Science*. N.Y.: Pergamon Press.

Schuster, M. R. and S. R. Van Dyne, eds., (1985). *Women's Place in the Academy: Transforming the Liberal Arts Curriculum*. Totowa, NJ: Rowman & Allanheld.

Soble, A. (1983). Why Should More Women Be Scientists? In M. Triplette, eds., *Women's Studies and the Curriculum: Proceedings on the Conference of "Scholars and Women," March 13-15, 1981* (pp. 43-54). Winston-Salem, NC: Salem College.

Stanworth, M. (1987). *Reproductive Technologies*. Cambridge: Polity in Association with Blackwell.

Stimpson, C. (1983). Scholarship About Women: The State of the Art. In M. Triplette, ed., *Women's Studies and the Curriculum: Proceedings on the Conference of "Scholars and Women," March 13-15, 1981* (pp. 111-22). Winston-Salem, NC: Salem College.

Weinreich-Haste, H. (1986). Brother Sun, Sister Moon: Does Rationality Overcome a Dualistic World View? In J. Harding, ed., *Perspectives on Gender and Science* (pp. 113-31). London: Falmer Press.

Winner, L. (1986, April). On the Foundations of Science and Technology Studies. *Science, Technology and Society Curriculum Newsletter of the Lehigh University STS Program*, Number 53, pp. 6-8.

COURSE SYLLABUS

SCIENCE IN SOCIETY

Soc. 0312
Fall 1991

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Description: The course will convey an understanding of the social structures and processes of scientific activity (and not the cognitive contents of scientific knowledge.) What is the significance of science in modern society? How has science shaped our lives, and how will it shape our future, in culture, everyday life, welfare and warfare? How is science directed--by intellectual curiosity within an ivory tower or also by practical and technical problems in industry, military, and other sectors? Who participates in science? Why are so few women and minorities engaged in this enterprise where gender and origin would seem irrelevant? How does the cultivation of science in universities shape the teaching for students? How is science done, by researchers solitarily drawing logical conclusions from experiments and observations of natural phenomena, or also collaborating and exchanging ideas with one another locally and at a distance, as they compete to be first or best in their research? How does worldwide economic competition among firms and countries induce research and, in turn, how does scientific knowledge shape technological innovation and international competitiveness (notably among USA, Japan, and a unified Europe)? Are less developed countries (e.g. in Latin America, and perhaps also Eastern Europe) increasingly lagging behind?

These questions concern why science is socially valued, how society supports scientific activity, how scientific activity is organized, and how scientific knowledge is utilized in society. These questions will be examined through readings on theory and evidence about scientific activity. Science is a world-wide activity, so the perspective will be global. The materials include comparisons between the USA and other places (Europe, Japan, Latin America, and Eastern Europe and the Soviet Union), and also a study of a typical American university as an organization for the creation, diffusion, and transmission of scholarly knowledge.

Science will thus be considered as a social institution with institutional characteristics and dynamics of its own but also linked to other social institutions such as education, religion, the military, the economy, and the polity. More precisely, the sequence of topics will be the following:

Science as a social institution with its own values and norms regulating scientific activity.
The historical establishment of science as social institution in Europe in the 17th century.
Science linked to education, notably in the university as an organization combining them.
Science linked to social stratification, as in the case of gender.
The development of science as a global system.
Fragmentation in the global system of science, as in the cleavage between East and West.
Science linked to the military, as in the recent race between the USA and the USSR.
Scientists' participation in world science, as in university scientists' worldwide ties.
Science linked to development in developing countries, as in Latin America.
Science linked to global economic competition, notably among USA, Europe, and Japan.

Purpose: The course aims at conveying knowledge of the social structures and processes of scientific activity. This serves the purpose of providing an appreciation and understanding of the significance of science and thereby providing general education for students by augmenting their specialties.

More precisely, the course serves different purposes for different kinds of students, depending on their specialized education. For students oriented towards the natural, technological, and medical sciences, the course will augment their understanding of scientific theory and principles by acquainting them with how science is shaped by and shapes society. For students oriented towards social sciences, humanities, and liberal arts, students who often shy away from courses on scientific theory and principles, this course will acquaint them with science in another way, not as a body of esoteric knowledge to be absorbed, but as a social enterprise that is pursued and cultivated partly for its own sake and partly for its applications in society.

Furthermore, the course in general, and the material on American universities in particular, will enhance the students' understanding of their own education. Also, this course aims at enhancing students' 'international competence' by its global perspective on science and by focusing on the participation of individuals, organizations, nations, and world-regions in the global scientific activity.

Format: The format of the course is a combination of lectures, recitations, and exams. Lectures by the instructor will include illustrative examples. Readings for each lecture will be mostly theoretical but will also often include evidence. Evidence, often provided in tables, will be interpreted and discussed mainly in recitation sessions. In preparation for the weekly recitation, students will read a short text or tables with questions. This weekly assignment consists of specific questions to be considered by each student as homework. Answers should be written down and brought to recitation (but not handed in) and then discussed in the recitation. A mid-term exam and a final exam will include multiple choice questions and very brief essay responses.

Credits: The course satisfies the General Education Requirement for the Social Sciences as a course meeting the 'Social Science Requirement' (category 5). Therefore, in addition to providing an understanding of the subject matter, namely science as a social activity, the course will provide an understanding of 1) the sociological study of a social institution and the social processes in the institution, here science; and 2) a variety of sociological methods such as designs that are comparative and historical; techniques of data collection by participant observation, interviewing, and archives; and analyses of data that are quantitative and qualitative.

The course is also listed as an area course for students enrolled in the Asian Studies Program, in the Latin American Studies Program, in the West European Studies Program, or in the Russian and East European Studies Program. Thus, the course will deal not only with American science, but also specifically with science in each of these areas.

Prerequisites: No requirements. The course is addressed to students at all undergraduate levels and in all disciplines.

Enrollment: Enrollment will expectedly be about 100 students, roughly half of whom will be entry-level undergraduates. Most will be students from the natural sciences, some from technological sciences, some from medical and other health sciences, some from social sciences, and some from the humanities, including history and philosophy of science. Several will be enrolled in the area studies programs (Asian Studies, Latin American Studies, Russian and East European Studies, and West European Studies).

Course requirements:

1. The required text is *Science in Society: Theory and Evidence*, edited by Thomas Schott. This reader is a collection of articles and statistical tables. The reader should be bought in the Book Center. The assigned reading for each class is expected to be completed before coming to class. Lectures will not summarize the reading but will build on and complement the reading.
2. The recitations will discuss weekly small homework assignments. The assigned homework for each recitation is expected to be completed before coming to recitation but should not be handed in. The recitation will provide feedback on the completed homework by discussing solutions to the assignment.
3. Exams include multiple choice questions and very brief essay responses. The mid-term exam is scheduled to be held in class on October 23, and the final exam is scheduled for December 12.

Grading policy:

1. Students will be evaluated by participation and discussion of homework in recitations (25%), mid-term exam (25%), and the final exam (50%).
2. Late work or absence from exams is unacceptable, except when caused by documented illness or similarly excusable and documented circumstances.
3. Cheating and plagiarism are proscribed following university policy.

SCHEDULE OF TOPICS AND READINGS

(Lectures, Monday and Wednesday; Recitations, Thursday or Friday)

I. SCIENCE AS A SOCIAL INSTITUTION

Wednesday, August 28 ***Significance of Science for Society.***

Reading: No reading for this introductory lecture.

This lecture will consider the social value attached to science in modern society. Science is a cultural tradition, preserved and transmitted from generation to generation partly because it is valued in its own right, and partly because of its wide technological applications. A distinguishing characteristic of the tradition is that the primary purpose of its cultivators, the scientists, is to change the tradition through discoveries.

Thursday/Friday, August 29/30 ***Aspects of Science.***

Reading: Course description and schedule (16 pages; this reading is in the course package at the Book Center).

Read the course description and schedule before coming to this first recitation. Which aspects of science will be considered in this course, and which will be ignored? Discuss this and the substance of the first lecture at the recitation.

Monday, Sept. 2 Labor Day. No classes.

Wednesday, Sept. 4 ***Institutional Characteristics of Science.***

Reading: Barber, "Science: The Sociology of Science," *International Encyclopedia of the Social Sciences* 14 (1968): 92-99.

Storer, "The Internationality of Science and the Nationality of Scientists," *International Social Science Journal* 22 (1970): 80-93.

These two articles are expected to be read before the class. Upon reading these articles, you should be able to answer the following questions. What is meant by a social role, and what characterizes the social role labeled 'scientist'? What is meant by a social institution and by institutionalization; what are some major

social institutions in modern society; and what characterizes the social institution of science? How is a scientist's role performance rewarded? What is meant by a social norm, and what are the norms of science? The lecture will consider science as a social institution in modern society. Science is a social institution in so far as scientific activity is recognized as valuable in itself, in so far as the conduct of its practitioners is regulated by norms consistent with the aims of the activity, and in so far as the activity has some autonomy from other social institutions. Science has considerable autonomy from many social institutions, but it is also linked with other social institutions such as education, religion, the economy, the military, and the polity.

Thursday/Friday Sept. 5/6 ***Affirmation and Rejection of Belief in Universality of Scientific Knowledge.***

Reading: Hardy, "The J-type and the S-type among Mathematicians," *Nature* 134 (Aug. 18, 1934): 250.

"Fukozawa's 1882-essay," *Historical Studies in the Physical Sciences* (1975): 26.

"Against the Bourgeois Ideology of Cosmopolitanism," *Current Digest of the Soviet Press*, 1, no. 1 (1949): 9.

As will become usual, each student is expected to complete the following homework in preparation for the recitation; write your answers down and bring them to recitation but do not hand them in. Read the three statements and interpret what each statement means. Is the author affirming, rejecting, or ambiguous about the universal validity of scientific knowledge? Compare the statements to each other; is one argument in and of itself stronger than the others, or can a definitive adjudication not be made? The recitation will be a presentation and discussion of the students' answers to the homework.

The above sessions offer an understanding of scientific activity as a social institution in modern society. The following sessions will trace the historical origins of the establishment.

II. HISTORICAL ESTABLISHMENT OF SCIENCE AS A SOCIAL INSTITUTION IN EUROPE IN THE SEVENTEENTH CENTURY

Monday, Sept. 9 ***Institutionalization of Science in England in the Seventeenth Century.***

Reading: Ben-David, "The Scientific Role: The Conditions of Its Establishment in Europe," *Minerva* 4 (1965): 15-50.

This reading and the lecture describe how science became established as a social institution in the first place and time, namely in Europe and more precisely in England in the seventeenth century. This was concretely manifested in the founding of the Royal Society of London. This lecture will thereby provide further understanding of what a social institution is and how a social activity may become established by a process of institutionalization.

Wednesday, Sept. 11 ***Religion as a Historical Link in Institutionalization.***

Reading: Merton, "The Puritan Spur to Science," *The Sociology of Science*. 1938. Chicago: Univ. of Chicago Press. 1973, pp. 228-53.

The reading and lecture consider how a certain ethos (values, preferences, and attitudes), namely a Protestant or, more precisely, Puritan ethic promoted interest in and acceptance of science as an activity valued in its own right. This shows how science was related to another social institution, namely religion.

Thursday/Friday Sept. 12/13 ***The Economy and the Military as Historical Links in Institutionalization.***

Reading: Merton, "Some Economic Factors in Seventeenth Century English Science," *Scientia* (1937): 142-52.

Merton, "Science and Military Technique," *Scientific Monthly* 41 (1935): 542-45.

As usual, each student is expected to complete the following homework in preparation for the recitation;

write your answers down and bring them to recitation but do not hand them in. The recitation will consider how science was related, through technology, to other social institutions, namely the economy and the military. Specifically, the recitation will discuss the students' answers to the following questions. What are the phenomena examined in each of the two brief articles? What is the hypothesis tested in each? How are the phenomena measured? What conclusions are drawn in each article?

The above sessions show that science became established as a social institution as a result of favorable conditions in other social institutions, namely religion, the economy, and the military. The next sessions will focus on the link science has with yet another social institution, namely education.

III. SCIENCE LINKED TO EDUCATION: THE UNIVERSITY

Monday, Sept. 16 ***The University as an Organization Combining Science and Education.***

Reading: Ben-David, "Science and the University System," *International Review of Education*, 18 (1972): 44-57.

This reading and the lecture deal with how the social institution of science is linked to education as another social institution in modern society. This link is formalized in the university as an organization combining education and scientific research. Specifically, the reading and the lecture will focus on how science and education have been combined at various times in various places--England, France, Germany, and the U.S.

Wednesday, Sept. 18 ***Trends in American University Science.***

Reading: Nelkin, "Intellectual Property: The Control of Scientific Information," *Science* 416 (May 14, 1982): 704-8.
Etzkowitz, "Entrepreneurial Science in the Academy," *Social Problems* 36 (1989): 14-27.

This reading and the lecture focus on recent changes in American universities, specifically the strengthening of the link between science and economy.

Thursday/Friday Sept. 19/20 ***Constraints on Students.***

Reading: "New Pentagon Rules on Overseas Students," *Nature* 287 (Feb. 26, 1981): 736.
"Universities Complain at Pentagon Policy," *Nature* 290 (April 9, 1981): 435.

As usual, each student is expected to complete the following homework in preparation for the recitation; write your answers down and bring them to recitation but do not hand them in. The readings provide an example of links among social institutions: science, education, and the military. Describe these links among the institutions; which institution attempts what influence on which institution? How do effects have indirect ramifications? Are the institutions receptive to influence, or do they seek autonomy?

The above sessions consider how science is linked to education in the form of universities as organizations that vary in place and in time.

IV. SCIENCE LINKED TO SOCIAL STRATIFICATION: THE CASE OF GENDER

Monday, Sept. 23 ***Gender and Science.***

Reading: Reskin, "Sex Differentiation and the Social Organization of Science," in J. Gaston, ed., *The Sociology of Science.* San Francisco: Jossey-Bass, 1978, pp. 6-31.

This reading and the lecture consider how science is linked to social stratification, statuses that people occupy in society. An example of such a status is gender, an individual characteristic that matters in much of social

life, e.g. in roles in the family. One of the social norms in science is universalism (as considered in the first sessions of this course) prescribing scientists to consider gender as irrelevant. This session will focus on the apparent paradox between universalism in science and the lack of universalism in much other social life as this paradox unfolds around the status of female versus male scientists.

Wednesday, Sept. 25 ***Women in Science.***

Reading: Cole, "Women in Science," *American Scientist* 69 (1981): 385-91.

The reading and lecture continues to examine the link between universalism in science and gender status. The above session is theoretical; this session considers some evidence.

Thursday/Friday, Sept. 26/27 ***Gender Relations in Science.***

Reading: Schott, "Tables on Gender Relations," (unpublished, 1991).

The recitation will consider some evidence on gender statuses, in social life generally and in science specifically. One table is based on a survey in the general population of Americans and shows the extent to which men have male and female friends and to which women have male and female friends. Is this table evidence of gender segregation (or absence thereof) in social life? Another table is based on interviews with scientists and shows the extent to which male scientists interact with male and female colleagues and to which female scientists interact with male and female colleagues. Is this table evidence of gender segregation (or absence thereof) in science? Compare the two tables; are they similar or different? If they are different, then interpret the difference, i.e. why are they different? As usual, bring your written answer to the recitation.

The above sessions consider the organization of scientific activity with a focus on the informal collegial relations among scientists, as they are regulated informally. The next sessions continue to focus on collegial networks in science but switch from the micro-level of individual scientists to the macro-level of global networks.

V. DEVELOPMENT OF THE GLOBAL SYSTEM OF SCIENCE

Monday, Sept. 30 ***The Historical Spread of Science Around the World.***

Reading: Shils, "The Cognitive Expansion from Centre to Periphery," *in Say Not the Struggle* (1976), pp. 63-94.

An earlier week focused on how science first became a social institution in Europe in the seventeenth century. Other civilizations also accumulated knowledge about natural phenomena, but these traditions did not evolve into social institutions. Rather, the European social institution of science spread around the world. The reading and the lecture consider how science spread and was adopted around the world.

Wednesday, Oct. 2 ***The Global System of Science.***

Reading: Schott, "The Scientific World System: Conceptualization," *Science, Technology & Human Values* (forthcoming).
Schott, "Globality and Globalization of Science," *Minerva* 4 (Winter 1991/92).

The reading and lecture considers the present-day global system of science. Not only is science institutionalized nearly everywhere, but collegial relations among scientists largely span the globe.

Thursday/Friday Oct. 3/4 ***The Centrality of U.S. Science in the Scientific World System.***

Reading: Schott, "Table on World Population, Economy, and Science," (unpublished, 1991).

The recitation will focus on the position of American science in the global system. The level of science in a country can be indicated by its scientific publications. Looking at the tables of countries of authors of publications, how does the level of science in the United States compare to the level in each other major country? Scientific influence can be indicated by citations, footnotes in the literature referring to earlier literature. Looking at the table of influence in the reading "Globality and Globalization of Science," where are the centers of influence, where are the peripheries in the world, and which places seem most isolated? As usual, write your answers down and bring them to recitation.

The above sessions focus on the global system. The next sessions deal with regions and specific countries within the global system.

VI. FRAGMENTATION IN THE GLOBAL SYSTEM OF SCIENCE: WESTERN AND EASTERN EUROPE

Monday, Oct. 7 ***East Bloc Disintegration in Science.***

Reading: Jordan,"Scientific and Technical Relations Among Eastern European Communist Countries," *Minerva 8* (1970): 376-95.

The East Bloc denotes the several countries of Eastern Europe and the Soviet Union which dominated that region politically, militarily, and economically until the recent disintegration. The reading and the lecture consider science in the region, specifically whether the region was cohesive in science and whether it has undergone disintegration in science.

Wednesday, Oct. 9 ***European Community Integration in Science.***

Reading: Schott, "Fragmentation in the Scientific World System," (manuscript, 1991).
Dickson et al, "European Science (Science and mutual self-interest, etc.)," *Science* 237 (Sept. 4, 1987): 1101-14.

Western Europe, in contrast to Eastern Europe, has been moving toward political-economic integration. The reading and the lecture examines whether Western Europe has been moving toward integration in science.

Thursday/Friday Oct. 10/11 ***National Science in International Contexts.***

Reading: Schott, "Tables on Science in Sweden: Nordic, European, and American Environments," *Cerum*, 91:16.

The recitation will focus on how a West European country is located in multiple environments, integrated within a small region, integrated within Western Europe, and integrated with American science. Where is integration weakest, and where is it strongest? Write your interpretations down and bring them to recitation.

The above sessions deal with the rather informal organization of scientific activity across national boundaries. The next sessions also deal with an international aspect of science, namely how science is linked to competition among countries for superiority, militarily, and/or economically.

VII. SCIENCE LINKED TO THE MILITARY: SOVIET AND AMERICAN SCIENCE

Monday, Oct. 14 ***Soviet Science.***

Reading: Kneen, "Soviet Scientists and World Science," and "Planning and Leadership," *Soviet Scientists and the State*. Ithaca, N.Y.: SUNY Press, 1985, pp. 33-63.
Schott, "Soviet Science in the Scientific World System," *Knowledge: Creation, Diffusion & Utilization* Vol. 13, no. 4 (June 1992) in press.

The two largest scientific establishments in the world are those in the United States and in the Soviet Union. This reading and lecture will deal with Soviet science and contrast it with American science, and focus on their different positions in the global system.

Wednesday, Oct. 16 ***The Cold War Spur to Science: American-Soviet Competition.***

Reading: Sapolsky, "Science, Technology and Military Policy," in D. Spiegel-Rosing, et al, eds. *Science, Technology and Society.* Beverley Hills, CA: Sage,1977, pp. 443-62.
Murphy, "The White House since Sputnik," *Fortune* (1958): 98-101, 228, 230, 232.

In an earlier week we dealt with how science was linked to the military during the institutionalization of science in seventeenth-century England. This reading and the lecture deal with how the recent military competition between two superpowers spurred scientific activity.

Thursday/Friday Oct. 17/18 ***Science Linked to the Polity, Military, and Economy.***

Reading: Eisenhower, "Farewell Address to the Nation," in S. Ambrose and J. Barber, eds., *The Military and American Society.* New York, N.Y.: Free Press, 1972, pp. 61-63.

In Eisenhower's description, what were the earlier links among the four social institutions, science, polity, military, and industry, and how have these links changed? Did he consider the changes preferable or not? Write your answers down and bring them to recitation.

Monday, Oct. 21 ***Scientific Knowledge as a Source of Military Power.***

Reading: Sherwin, et al, "Project Hindsight," *Science* 156 (June 23, 1967): 1571-77.
Thompson, "TRACES: Basic Research Links to Technology Appraised," *Science* 163 (Jan. 24, 1969): 374-75.

The reading and the lecture will focus on the same question that was considered around the institutionalization of science, namely how closely or remotely the development of scientific knowledge has been linked to military innovations. Analyze the two readings, compare them to pinpoint similarities and pinpoint differences, and try to explain differences.

The above sessions deal with how science is linked to another social institution, the military, through technology. Later we will deal with how present-day science is linked through technology to yet another social institution, namely the economy.

Wednesday, Oct. 23 **Mid-term Exam.** In-class multiple choice and brief essay test based on readings, lectures, and recitations.

Thursday/Friday Oct. 24/25 **Solutions to Exam.**
The recitation will discuss solutions to the mid-term exam.

VIII. SCIENTISTS' PARTICIPATION IN WORLD SCIENCE

Monday, Oct. 28 ***Individual Participation in Science.***

Reading: Hagstrom, "Social Control in Science," *The Scientific Community* (1965): 9-52.

The earlier sessions have dealt with institutional characteristics of science such as what characterizes science as a social institution and how science is linked to other social institutions. We now turn to a consideration of how individual scientists participate in the enterprise. This reading and lecture focuses on describing how a scientist performs the scientific role in the social institution. This session is theoretical; the next session brings evidence.

Wednesday, Oct. 30 *Professors' Collegial Context for Teaching and Research.*

Reading: Schott, "Pitt Sociologists' Ties," to appear in a self-study of the Dept. of Sociology.

The reading and lecture is a study of how Pitt professors enact their research and teaching roles in the context of local and distant colleagues. This session will show results of a study and also show how scholarly activity can be investigated, here with a questionnaire survey.

Thursday/Friday Oct. 31/Nov. 1 *American Scientists' Ties to Local and Foreign Colleagues.*

Reading: Schott, "Tables on U.S. Scientists' Ties," (from the manuscript *Hierarchy and Regionality in Science*).

The recitation will consider evidence of the collegial context in which Pitt's natural, medical, and technological scientists perform their role as researchers. To what extent are they locally oriented and to what extent is their orientation cosmopolitan? What are their channels of communication? Write your interpretations down and bring them to recitation.

The above examination of scientists' participation in science will be continued in following sessions, but the focus will switch from a central country to the periphery of world science.

IX. LATIN AMERICAN SCIENCE

Monday, Nov. 4 *Institutionalization of Science in Latin America.*

Reading: Schwartzman, "The Quest for University Research: Policies and Research Organization in Latin America," in *The University Research System* (1985): 101-15.

The course has hitherto dealt with science in developed countries. Science is less firmly institutionalized in developing countries such as the countries of Latin America. This reading and lecture deals with the institutionalization of science in Latin America.

Wednesday, Nov. 6 *Latin American Scientists' Participation in World Science.*

Reading: Schott, "Periphery-center Relations in Science: Latin American and U.S. Scientists' Ties," manuscript, 1991.

The reading and lecture deals with how scientific activity in a developing country is a periphery dependent on and dominated by science in the center, the United States. This study of Brazilian science is based on a questionnaire identical to that used for American scientists.

Thursday/Friday Nov. 7/8 *Comparison of American and Latin American Science.*

Reading: Use Tables From Preceding Class on U.S. Scientists and Latin American Scientists.

Compare the study of Brazilian scientists with the study of American scientists. What are the similarities between scientific activity in Brazil and the U. S.? What are the differences, and what might explain them?

The focus on developing countries will be continued in the next sessions.

X. SCIENCE LINKED TO SOCIO-ECONOMIC DEVELOPMENT IN DEVELOPING COUNTRIES

Monday, Nov. 11 *Science in the Developing Countries.*

Reading: Frame, "Science and Technology in Less Developed Countries," *International Business and Global Technology* (1983): 37-52.

The reading and lecture deals with the situation of science in less developed countries.

Wednesday, Nov. 13 *Science Policy for Development in Developing Countries: Latin America.*

Reading: Vessuri, "*O Inventamos o Erramos*: The Power of Science in Latin America," *World Development* 18 (1990): 1543-51.

Illustrating development in less developed countries, the reading and the lecture again focus on Latin American countries, both past accomplishments and failures of science policies and future alternatives.

Thursday/Friday Nov. 14/15 *The Scientific Gap Between Developed Countries and Developing Countries.*

Reading: Use the earlier "Table on World Population, Economy, and Science," Schott, 1991, unpublished.

Interpret the table on the distribution of the world's population, economy, and science at two points in time. Has the scientific gap between the developed countries and the developing countries narrowed, remained unchanged, or widened?

The above examination of how science is linked to material production will be continued in the next sessions, but focus will switch from developing to developed countries, and the crucial issue thereby switches from survival of populations to economic competition for profits among transnational companies.

XI. SCIENCE LINKED TO THE WORLD ECONOMY

Monday, Nov. 18 *Science Linked to Technology and Thereby Economy.*

Reading: Gibbons et al, "Relationship between Science and Technology," *Nature* 227 (1970):125-27.
Ben-David,"Research & Economic Growth," *Fundamental Research and the Universities* (1968): 55-61.
Pavitt, "What Makes Basic Research Economically Useful?" *Research Policy* 20 (1991): 109-19.

An earlier session considered how science was linked to the economy when science became established as a social institution. We now pursue this link in the present-day society. The readings and the lecture deal with the ways and extents science is linked, through technology, to the economy. This session focuses on the multifaceted link itself, the next sessions focus on the global market forces linking science with the economy, on policies for linking science and economy, and on organization of the link.

Wednesday, Nov. 20 *Science Spurred by Competition in the World Economy.*

Reading: Nelson, "Capitalism as an Engine of Progress," *Research Policy* 19 (1990): 193-212.
Frame, "Technology and International Business," *International Business and Global Technology* (1983): 1-19.

The readings and the lecture focus on the global market mechanisms spurring science.

Thursday/Friday Nov. 21/22 *Scientific, Technological, Economic Competition Among USA, Japan, Europe.*

Reading: Schott, "Tables on USA, Japan, and Europe in Science, Technology and Economy," (1991, unpublished).

Interpret the tables on national levels and growth of performance in the triad of competing powers. Which place leads in the competition in science, in technology, and in economy? Is the same place ahead in all three activities? Which place has grown fastest in each activity? According to this evidence, do scientific growth, technological innovation, and economic performance appear to be causally interrelated?

The above sessions focus on how science, technology, and the economy may affect one another. The next sessions will focus on the political mechanisms and the organizational mechanisms bringing such effects about.

XII. ORGANIZATION OF SCIENCE, TECHNOLOGY AND BUSINESS IN JAPAN AND USA

Monday, Nov. 25 *Policies for Science-Technology-Economy in Japan and in the USA.*

Reading: Marshall, "U.S. Technology Strategy Emerges," *Science* 252 (April 5, 1991): 20-24.
Lynn, "Japanese Research and Technology Policy," *Science* 233 (July 18, 1986): 296-300.
Vernon, "A Strategy for International Trade," *Issues in Science and Technology* (1988/89): 86-91.

The link between science and economy may be shaped by policies toward these activities, i.e., science policies, technology policies, and industrial policies. Such policies vary in time and place. This reading and lecture consider policies in the two leading countries, the United States and Japan.

Wednesday, Nov. 27 **Thanksgiving Recess. No class.**
Thur/Fri., Nov. 28/29 **Thanksgiving Recess. No recitation.**

Monday, Dec. 2 *Organization and Management of Research in Japan and in USA.*

Reading: Mansfield, "Industrial Innovation in Japan and the United States," *Science* 241 (Sept. 30,1988): 1769-74.
Heaton, "The Truth about Japan's Cooperative R&D," *Issues in Science and Technology* (Fall 1988): 32-39.
Schott, "Organization of Research in Japan," manuscript, 1991.

The link between science and economy is effected through organization of these activities, which varies in time and place. This reading and lecture consider organization in the two leading countries, the U.S. and Japan.

CONCLUSIONS

Wednesday, Dec. 4 *Conclusions: The Social Institution of Science.*

Reading: Ben-David et al, "Sociology of Science," *Annual Review of Sociology* 1 (1975): 203-18.

The approach taken in this course has been to disentangle the institutional characteristics of science and its links with other social institutions, as these vary in time and place. Having disentangled them, this reading and lecture will attempt to bring them together again into a coherent account of science as a social institution, partly autonomous and partly reciprocally linked with other social institutions.

Thursday, Friday *Methodological Summary: Analyzing a Social Institution.*
Dec. 5/6

Reading: Schott, "Table for Classifying Articles Read in This Course," (unpublished, 1991).

This course, besides providing an understanding of the social institution of science, has aimed at illustrating a variety of sociological methods for investigating the social structures and processes of science. Homework for this last recitation is to consider each article read in the course and to classify it according to its method. Write your responses in the table provided for this classification.

Thursday, Dec. 12 **Final Exam**, 10:00 - 11:50 a.m.

The exam will be a multiple choice and brief essay test, partly based on readings of theory and evidence and on lectures and recitations.

THE BATTLE OF THE BOOKS: POSTMODERN RESPONSE AND RESPONSIBILITY

In *The Battle of the Books: The Canon in the Age of a New Technology*, a stimulating discussion that recently appeared in this space (June 1991), Neil Kleinman argues that ongoing changes in values generally and in The Canon specifically are "the result of changes in media, expansions in audience, and the development of new technologies." The substance of the argument itself--presented with clarity and thoughtfulness--seems beyond reproach. However, as postmodern fellow-travelers (whose thought and work we hope is marked by openness and playfulness equally), we feel compelled to question Professor Kleinman's tenor and, in some measure, his (apparently approving) conclusion: "farewell, 'The Great Books' list and 'The Five-Foot Shelf' of Books." The point of this dissent may seem trivial, but one of the recurring lessons of the postmodern sciences is that even subtle differences, differences of degree or emphasis rather than of kind, can sometimes cause significant differences in development--the principle of the Butterfly Effect extends to knowledge itself.

As Professor Kleinman makes clear, the unfolding postmodern shift is nothing to sneeze at. For the first time since the Renaissance, the concept of a unity of knowledge is being seriously questioned, and our students thus find themselves trying to fathom a sociophilosophical transition the equal of which very few generations have had to confront. While it is certainly clear that the old unities cannot explain the present, it is also clear that the new fragmentations are equally unsuccessful, ultimately unresponsive to the crying need of each of us for meaning beyond our so obviously finite selves.

Professor Kleinman reminds us that successful new technology "becomes the metaphor used to describe the world," but modern linguistics has revealed the great gap between what we say and what we are talking about, between the word and its meaning, a gap that yawns even more dauntingly at the level of metaphor. We are beginning to realize to what extent language itself shapes the "reality" it purports to describe. Consequently it is little wonder that once having accepted a paradigm's metaphors as appropriate descriptions of the world, once within the paradigm's "magic circle," one may find it difficult to leave. For a very long time the universe appeared to be perfectly orderly and coherent, so that accidents and uncertainty were seen as illusions engendered by a deficiency of information. Now we may be prone to think that all coherency has been lost, i.e., that all "realities" are social or psychological creations. However, as Jonathan Mark Smith has written (1991), while we can deconstruct the text of a sign at the beach which proclaims "Beware of the sharks," the actual waters "are teaming with real, live, and quite implacable sharks." Gravity does not capriciously take a few days off each month. The universe is describable (albeit roughly) in differential equations. There are strong attractors. The challenge of postmodern science, in other words, requires us to deal with a Nature which is <u>both</u> cosmic and chaotic.

The spirit of liberty (and science) lies in being uncertain one is right, but perversely enough, even an epistemology of uncertainty can come to be assumed, to be "certain." Frankly, American 20-year-olds need not be "taught" the

relativity of Truth any more than they need voicing of, say, the desirability of the good material life. Uncertainty is the bedrock (excuse the pun) of their age. What our students most desperately need is to consider the arguable shortcomings of and alternatives to their ways of thinking and being. If only for the sake of perspective, it is imperative that they be able to step outside the enchanted circle of their own epoch's dominant world view.

Let us consider for a moment three long-standing virtues which seem to be weathering poorly the powerful storm of postmodern popculture: authority, humor, and tolerance. (The list hardly stops here; also among the teetering touchstones of value are work, silence, transcendence, and the idea of value itself.)

The decline of traditional authority is so justified that one is at first inclined to regard its collapse as no sacrifice whatsoever. But after a bit of reflection, one may recall what might be called the "crossing guard" truism: given how slowly individual humans mature and given the capricious contingency of life, all of us need the guidance of crossing guards (and numerous others), if we are to survive, much less thrive. But now, alas, even genuine authority (i.e., that derived from the insight and experience of those sage-exemplars we now trivialize as "role-models") is closer to extinction than the snail darter, a sad truth which may be easily observed in frenzied high school classrooms across the country. To "teach" ("to show, guide, direct, impart") in a context where the apprentice's understanding is considered (at least) as valid as that of the master is a contradiction in terms, and hopeless.

Humor, always a vital touchstone with humility, becomes even more important whenever, as now, centers are failing and assumptions unraveling. Gravitas is fine if one is perfecting a golf swing or a recipe for Key Lime Pie, but as Vaclav Havel has written, when one is dealing with the highest, ultimate ends, a readiness to laugh is essential. The catch is that all true humor is, in a sense, immoral: without a butt, there is no joke. But paradoxically, when we laugh at Charlie Chaplin slipping on a banana peel, a dozen Aggies replacing one light bulk, or the self-important priggishness of mostly forgotten DWEM's (dead white European males), we laugh at, and reconcile ourselves to, our own contingency and frailty. Apart from suffering (a close cousin of delight), there is probably no other pathway to accepting one's own shortcomings and, thus, to achieving empathy. Hence, the surest test of a "civilization" is its ability to laugh at itself. And how healthy is humor in late-twentieth-century America? The signs are not good. Consider that Huckleberry Finn, that epitome of unflinching "immorality," is under attack, while the witlessness of most commercial television comedy speaks for itself.

If there is one personal characteristic we profess to admire even more fervently than humor, it is tolerance. Far from a presumption that all ideas are equally valid, tolerance is a quality of mind which demands careful examination of each new proposition and perspective because these might turn out to be superior to existing conceptions. Yet while tolerance thus respects, even celebrates significant difference, it abhors the undiscriminating pseudo-tolerance which glorifies an ersatz variety among ever-flatter mindscapes and which thereby trivializes the value of true diversity. Here is an easy test: although nearly all the meaningful contributions to the intellectual quest have been made by

unorthodox "oddballs," try to find an original "character" teaching today in your kid's public school....Of course, ordinary Americans--poorly educated, perhaps, but not stupid--intuit these losses. Hence their recognition of the authentic humor of *The Simpsons*, the evocative authority of Fred Rogers, and the discriminating tolerance of a sage like Joseph Campbell.

Changes in *Weltenschauung* are not always fruitful; sometimes they lead to dead ends. The long centuries following the fall of Rome were not without their luminaries, but they are not described as "dark" for nothing. Given the nature of human nature, and because Truth is (as Krisnamurti puts it) a "pathless land," progress is anything but linear. It is unlikely that we are witnessing the collapse of Western civilization and the beginning of a new age of barbarism; on the other hand, it would be disingenuous to deny completely that possibility. Every postmodernist's nightmare is a world in which the playful metaphor "anything goes" becomes literal truth; for if anything goes, then nothing matters, including the person-ness of individuals--and the loss implicit in that eventuality lurks among the shadows of postmodern possibilities.

As the postmodern pendulum swings, it seems altogether appropriate that focus is shifting from text to context and from author (authority) to reader (emancipation). All truth seekers must welcome the opportunity for idiosyncratic explorations offered by contemporary technology such as the hypermedia programs the Professor Kleinman describes. But in order for such explorations to bear fruit in the search for personal and communal coherence--to yield an experience in any way more substantive than a roller coaster ride or an ice cream feast--readers must have accumulated a reservoir of varying perspectives from which they may make considered rather than reactionary choices. In other words, to address context, to get beyond the tautology of I-am-who-I-am, readers must have a greater sense of their context than that offered by their own experience.

Professor Kleinman implies that when interpretation and control of the text lies exclusively with readers, a canon capable of linking all readers becomes problematic at best. Certainly a single, universal response to any text is impossible. But training a diversity of gazes on a common object, however fluid and subjectively constructed the images that present themselves to those gazes, at least offers a point of reference by means of which we can consider the value and meaning of our differences--both from one another and from the constructed voice we each hear speaking through the text--and of our likenesses. In the absence of all likeness, difference has no significance at all. Without some common points of reference (and here read <u>common</u> in the broadest sense, unlimited by any socially or historically constructed groupings of individuals), the technological potential for expanding and manipulating available material has about as much purpose as a Nintendo game.

What the postmodern spirit must seek is not merely a validation of our differences (a goal which understandably forms an urgent priority among people heretofore marginalized by socially constructed authority), but a perception of new unities, of the ways our similarities give significance to our differences (and vice versa), of how singular terms such as <u>life</u>, <u>human</u>, and <u>universe</u> embrace a plurality of potential. Achieving such a perception means finding ways to incorporate previous world views within the transformative processes of learning:

the old unities cannot be fairly judged if they are peremptorily dismissed as irrelevant or, in a simple inversion of historical injustice, themselves marginalized.

Having read a good deal of the "Five-Foot Shelf," we are, like Professor Kleinman, eager to hear the voices of the new Greats, more and more of whom will be female and non-European. We celebrate them. However, it seems irresponsible to suggest that what students read is unimportant "as long as they read the same things." In fact, Western students need, perhaps more than ever, to participate in a dialogue that connects them with the complex web of shared community and shared history of this world which we all must share. In the past professors could assume that students not only aspired to grapple with "high" questions of truth but--more importantly--were rooted in the traditional virtues ("do your best," "play fair") of the "low" culture of society at large. Such virtues, transcending the artificial prejudices of any particular culture, empower individuals, encourage community, engender responsibility, and enable learning itself.

Contemporary college students face lifetimes literally and figuratively in cyberspaces where time and place are increasingly irrelevant. As Kleinman says, their question again and again will be, Where are we? They are entitled to examine how others before them have grappled--sometimes brilliantly and bravely--with this very question. One of the primary goals of The Canon, in fact, was to reveal the values of rootlessness. Several works come to mind immediately as buoy markers in the pathless sea of ideas: *The Magic Mountain, The Odyssey*, Blake's *Selected Works, Don Quixote, Moby Dick, Walden, Hamlet, Through the Looking-Glass, The Mill on the Floss, The Education of Henry Adams*, and the *Meditations* of Marcus Aurelius, among others. This is of course a deficient list, for we must seek dialogue with other ethnicities and cultures than those represented here in order to see how ideology inevitably enters and influences every finite, fallible discourse (including this one). But when students have drunk deeply of even a few of these vintage tonics, they are better equipped to metabolize the modern feast of information. When they have practice using the hand tools and raw material of previous world views, they can more creatively--and more purposefully--manipulate the power and the plastics of the present.

Precisely because postmodern awareness forces us to question all assumptions, destabilizing the foundations of any vantage point, teachers and students alike need a common point of departure for their cooperative venture in learning, a provisional scaffolding from which to examine the structures of things, as well as the realization that it is, and must be, provisional. To undertake the challenge of education otherwise would be to violate our covenant with every thinker since those anonymous females who broke out of their enchanted circles and, beginning not merely farming but the whole process of changing world views, remembered nonetheless that some truths--life, beauty, goodness--are central.

--Jim Norwine
Prof. of Geosciences & Distinguished Alumni Research Prof. (1983), Texas A&I University, Kingsville, Texas

--Linda Ford Winans
Dept. of English, Tulane University, New Orleans, Louisiana

FOR CRYING OUT LOUD

Response to Professors Norwine and Winans

Let's get the question right. The question is not what is truth and what should we teach our students? If that were the question, "jesting Pilate" would not stay to listen.

The question is simpler. What does all this chatter about the canon mean? Why is the *idea* of The Canon so important to us now? The cry for order (and canons are about ordering things) comes when we are in chaos--in the same way that the fantasy of summer vacations comes when we are lost in the snows of winter. We cry for the opposite of what we have. Call it a theory of intellectual/emotional complementarity.

I start then with the view that when we cry for *order* we must be feeling overwhelmed by disorder. Professors Norwine and Winans seem to agree. "While it is certainly clear," they write, "that the old unities cannot explain the present, it is also clear that the new fragmentations are equally unsuccessful, ultimately unresponsive to the crying need of each of us for meaning beyond our so obviously finite selves."

Professors Norwine and Winans would like to prescribe the medicine. How can we make the patient more comfortable, they ask? An admirable question, but I want to begin the discussion several stages earlier: What is the disease? What are the symptoms? What are the causes?

Our sense of chaos may be the result of being overwhelmed by too many perceptions, too many points of view. As King Lear would have it, "I will do such things--What they are, yet I know not, but they shall be The terrors of the earth." That is the point, I think, we are now at. *We can do such things--What they are, yet we know not.*

Clearly we are overwhelmed by the diversity of new cultures, new voices, new "authorities." Others write about this. I wish to consider the impact of technology on our sense of order, on our old values, and on the new values and meanings we are attempting to develop in the flurry of our confusions.

It is worth being precise on several points.

First, to treasure the culture and art of the past is not necessarily to believe that they will continue to have the same weight and meaning in the present and future.

Second, to describe a time of chaos and change is not to be despairing. Those of us who grew up reading Renaissance literature know how exciting the times can be when the times are a-changing.

Third, to describe chaos and change is not necessarily to seek it nor invite it, nor to suggest that it is a condition we should promote in ourselves or our students.

Fourth, to describe is not to prescribe, although description may be a necessary prerequisite to prescription.

Much of what Professors Norwine and Winans promote as cures for our fragmentary culture are admirable prescriptions. I would only add that they may make us feel better as the medicine goes down, but I am not persuaded they will change our sense of uneasiness.

A scholar of the Renaissance and the Middle Ages once compared the two civilizations. He observed that whether or not the Middle Age civilization was as great as that of the Renaissance, it certainly was different. It is time to say the same thing about "our" civilization and the earlier ones represented by traditional canon theory. Things are certainly different.

--Neil Kleinman
Institute for Publications Design
Yale Gardner College of Liberal Arts
The University of Baltimore
Baltimore, Marylands

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- Strong ongoing research programs in the social implications of the life sciences
- Research equipment, travel and research funds, library and archival resources

For More Information Contact: Ms. Pat Dean, Graduate Field of Science and Technology Studies, 726 University Avenue, Cornell University, Ithaca, NY 14853. Phone: 607/255-6234. Fax: 607/255-0616. Members of underrepresented groups are especially encouraged to apply.

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VISITING SCHOLAR IN MOLECULAR GENETICS & INFORMATICS LABORATORY
Rockefeller University
Academic Year 1992-93

With funding support from the Mellon Foundation, the Laboratory has support for a graduate student or postdoctoral fellow or visiting professor interested in a period of residence in a working research laboratory. The program is intended to offer an opportunity for observation and "field" experience in the conduct of research on the part of a professional social scientist, philosopher, or historian. Existing laboratory members are sympathetic to such collaboration, and embrace skills ranging from molecular biology to computer expert systems; and some have a degree of experience in historical, philosophical, and sociological enquiry. Terms (from 2 months to one year) and stipend are negotiable. This opportunity should be of particular interest to a research fellow seeking a dissertation topic rooted in real, contemporary science; however, more advanced scholars should not be deterred from inquiring.

Contact: Professor Joshua Lederberg, 400 Founders Hall, The Rockefeller University, 1230 York Avenue, New York, New York 10021. Email: lederberg@rockvax.rockefeller.edu.

Forthcoming Meetings and Conferences

March 6-7, 1992. Indianapolis, Indiana. *Association for Practical and Professional Ethics*, 1st Annual Meeting. Contact: APPE, 410 N. Park Ave., Bloomington, IN 47405; [812] 855-0261; Email: APPE@IUBACS (Bitnet) or APPE@UCS.INDIANA.EDU (Internet).

March 16-18, 1992. *Stability and Change in Nature: Ecological and Cultural Dimensions.* Budapest, Hungary. Sponsored by International Forum for Biophilosophy, Hungarian Academy of Sciences, and Sigma Xi, The Scientific Research Society. Contact: Guido Van Steendam, IFB, Craenendonck 15, B-3000 Leuven, Belgium.

April 3-5, 1992. *Conference on Earth Rights and Responsibilities: The Confluence of Human Rights and Environmental Protection*, Yale University. Contact: Liz Barratt-Brown or David Christensen, National Resource Defense Council, 1350 New York Ave., N.W., Suite 300, Washington, D.C. 20005-4705; [202] 783-7800.

April 4-5, 1992. *Culture and Ethnicity of Industrialization*, Third Annual Woonsocket, Rhode Island National History Conference. Contact: Doug Reynolds, Blackstone River Valley National Heritage Corridor Commission, P.O. Box 34, Uxbridge, MA 01569; [508] 278-9400; or Scott Molloy, Labor Research Center, University of Rhode Island, Adams House, 85 Upper College Road, Kingston, R.I. 02881; [401] 792-2239.

April 5-7, 1992. *Theory Meets Practice*, Second International Conference on Ethics and Environmental Policies, Athens, Georgia. Contact: Peter G. Hartel, Symposium Coordinator, Dept. of Agronomy, 3111 Plant Sciences, Univ. of Georgia, Athens, GA. 30602; Phone: [404] 542-0898; Fax: [401] 542-0914.

May 2-3, 1992. *DIAC-92–Directions and Implications of Advanced Computing*, Berkeley, Calif. 4th DIAC Symposium sponsored by the Computer Professionals for Social Responsibility. Contact: Program Chair: Douglas Schuler, 2202 N. 41st St., Seattle, WA 98103; [206] 632-1659 (home); [206] 865-3832 (work), Email: dschuler@june.cs.washington.edu.

May 11-15, 1992. *History and Philosophy of Science in Science Teaching*, Second International Conference, Queen's University, Kingston, Ontario, Canada. Contact: Skip Hills, Conference Secretary, Faculty of Education, Queen's University, Kingston, Ont. K7L 3N6; Phone: [613] 545-6208; FAX: [613] 545-6584; Email: Hills@QUCDN.

June 14-20, 1992. *Visions for a Sustainable World*. Seventh Biennial Student Pugwash USA International Conference, Emory University, Atlanta, Georgia. Application Deadline: February 15, 1992. Contact: Timothy Larson, Student Pugwash USA, 1638 R Street, N.W., Suite 32, Washington, D.C. 20009; [202] 328-6555.

August 12-15, 1992. *4S/EASST*, Gothenburg, Sweden. The Society for Social Studies of Science annual meeting will be held jointly with the European Association for the Study of Science and Technology. Contact: John Hultburg, Center for Science Studies, Univ. of Gothenburg, S-41298 Gothenburg, Sweden. Phone: 46-31-631929; Fax: 46-31-634723.

August 16-21, 1992. *Society for the History of Technology*, Annual Meeting, Uppsala University, Sweden. Contact: Håkon With Andersen, Center for Technology and Society, Univ. of Trondheim at Lade, N-7055 Dragvoll, Norway. Phone: 47-7-591789; Fax: 47-7-591327; Bitnet: H_Andersen@ AVH.UNIT.UNINETT. For conference information contact: Uppsala Turist & Kongress, "SHOT," Box 216, S-751 04 Uppsala, Sweden. Fax: 46-18-132895.

October 9-10, 1992. *Interface '92*, Sixteenth Annual Humanities and Technology Conference, Marietta (metro Atlanta), Georgia. Proposal abstracts due by May 1, 1992. Contact: Mark Stevens or Pamela McMahon, Dept. of Humanities and Social Sciences, Southern College of Technology, 1100 S. Marietta Parkway, Marietta, GA. 30060-2896; [404] 528-7202.

October 8-11, 1992. *Society for Literature and Science*, Atlanta, Georgia. Proposal abstracts due by Feb. 1, 1992. Contact: Pamela Gossin, History of Science Dept., 601 Elm, Room 622, Univ. of Oklahoma, Norman, Okla. 73019.

January 3-8, 1993. *Science Education in Developing Countries: From Theory to Practice.* Jerusalem, Israel. Contact: Avi Hofstein, Dept. of Science Teaching, The Weizmann Institute of Science, Rehovot 76100, Israel; Phone: 972-8-342278; Fax: 972-8-344115; Email: NTHOFSTN@WEIZMANN.

OFFICE OF TECHNOLOGY ASSESSMENT REPORT

Federally Funded Research: Decisions for a Decade. Washington, D.C.: Office of Technology Assessment, Congress of the United States, 1991. Pp. 314. Bibliog. Paperback: $12.00.

This is an extremely important OTA study of the federally funded United States research system and the decisions it faces in the 1990s. In particular, it examines funding prioritization, trends in research expenditures, education and human resources, and the collection and analysis of data in support of ongoing research decision making. The report's focus is not on the size of expenditures, but rather on the "system" itself--how its subcomponents interact and what research is funded and subsequently carried out. The OTA assumes there will always be more opportunities than can be funded, and therefore takes as the appropriate objective attempts to ensure that a broad range of the best research is supported by the highest caliber scientists and engineers available. Although by charter, OTA does not propose policy, it can make recommendations to Congress of possible actions. In response to each of the four major issues, OTA has thus identified possible congressional and executive branch responses. OTA believes "priority-setting mechanisms that cut across research fields and agencies, and that make selection criteria more transparent, must be strengthened...." In addition, "the total Federal research portfolio [must be evaluated] based on national objectives, research goals, and agency missions." Such priority setting should also "promote education and human resources" and "balance little science and megaproject initiatives" (p. 13). In seeking to set priorities, it will be necessary to better understand changing expenditures for research and to "institute better cost-accountability and cost-containment measures by agencies and research performers," especially for indirect costs, megaprojects, and other multi-year initiatives (pp. 43, 13). Direct cost containment and subsequent evaluation for effectiveness may also be appropriate in some limited cases to be determined by research agencies. OTA believes educational and human resources availability for future needs can be met by encouraging "pipeline" programs that expand the number and diversity of students from K-12 through undergraduate levels. Total participation in science and engineering can also be increased by addressing the issues of opportunities and motivation for currently "underparticipating" groups. Agencies may also want to consider programs that are better adapted to changing models of research which involve larger teams, but with specialized responsibilities and a shared infrastructure (pp. 13, 28). Finally, OTA suggests both the augmentation and refinement of data collection and analysis on the federal research system and its subsequent use for congressional and executive branch policymaking (pp. 13, 36, 43).

The volume includes individual chapters devoted to the value of science in the changing research economy, the role of the executive and legislative branches and the research agencies of the federal research system, and separate chapters devoted to each of the four key issues. Numerous appendices including summaries of major federal legislation related to U.S. research and development (R&D), funding allocation by leading research agencies, research decision making in foreign countries, and leading U.S. academic institutions ranked by federal R&D funding received and citation impact complement the narrative text. The reference bibliography is excellent and brings together in one place a wealth of information.

Taken all together the material in this report represents a monumental cross-cutting accumulation and evaluation. As such it will be useful as both a resource document and an aid to federal research agenda setting as envisioned. However, it will also be very useful in a variety of classroom settings, both for upper-level policy-oriented courses and for introductory overviews. The initial summary chapter could well be used by itself. Especially at the price, this is a must volume for any serious scholar/teacher in the STS field.

BROWN, LESTER R.; CHRISTOPHER FLAVIN; AND SANDRA POSTEL. *SAVING THE PLANET: HOW TO SHAPE AN ENVIRONMENTALLY SUSTAINABLE GLOBAL ECONOMY*. WORLDWATCH ENVIRONMENTAL ALERT SERIES. NEW YORK, N.Y.: NORTON, 1991. 224 P. PAPERBACK: $8.95.

In this inaugural volume in a new Worldwatch Institute environmental series, Lester Brown and his colleagues confront the basic problem of creating a strong global economy without destroying the supporting and underlying ecosystem. Written in anticipation of the upcoming June 1992 UNCED "Earth Summit" Conference to be held in Rio de Janeiro, this book argues, not surprisingly, for an environmentally sustainable global economy. In their view "such an economy has a population that is stable and in balance with its natural support systems, an energy system that does not raise the level of greenhouse gases and disrupt the earth's climate, and a level of material demand that neither exceeds the sustainable yield of forests, grasslands, or fisheries nor systematically destroys the other species with which we share the planet" (p. 11). The first half of the book is devoted to the description of a sustainable economy, while the second half focuses on the specific policies that would be needed to effect such changes: carbon taxes on fossil fuels, extensive family planning, reforestation incentives, and global environmental restoration funds. Brown, et al believe the real challenge, both to the "Earth Summit" Conference specifically, and of society more generally, is to move beyond viewing environmental issues solely as discrete problems, focusing instead on "the basic economic and social reforms that are needed if we are to save the planet. And, indeed, to save ourselves" (p. 13). Although not every reader will readily agree with all the ideas expressed in this short overview, it is, nonetheless, an approach that must be considered in the face of "business-as-usual" approaches fraught with problems for large segments of the world's population. A provocatively useful supplementary text for a wide range of STS courses.

FOOTE, BUD. *THE CONNECTICUT YANKEE IN THE TWENTIETH CENTURY: TRAVEL TO THE PAST IN SCIENCE FICTION*. WESTPORT, CONN.: GREENWOOD, 1991. X, 209 P. BIBLIOG. HARDCOVER: $39.95.

Foote analyzes Twain's *Connecticut Yankee* as the first example of travel to the past to be found in "science fiction," a position for which he cogently argues. Foote then goes on to explore problems and themes found in later travel-to-the-past science fiction showing how most of them were prevised directly or indirectly in Twain's work. What remains curious to Foote though is why this theme fails to appear prior to *Connecticut Yankee*, leading him to ask four questions: "Why America? Why 1889? Why Mark Twain? And why, given all that can be said against it, does travel to the past appear throughout science fiction from Twain down even to the present day?" The answers are too complex to do justice to here in brief compass; a full reading will have to do that. However, they have to do with the convergence of a fading belief in progress, Twain's geographic location mid-way between the American East and West, and North and South, the strain between contemporary America and its European past in the late 19th century, and the emergence of new technologies of weaponry and transportation (the steamship) making imperialism possible. This is an intriguing volume for STSers, whether they are science fiction fans and teachers or not, for it raises interesting contextual issues regarding the role of technology, a theme central to the interpretation of both the novel and the field of study.

LUGER, MICHAEL I. AND HARVEY A. GOLDSTEIN. *TECHNOLOGY IN THE GARDEN: RESEARCH PARKS AND REGIONAL ECONOMIC DEVELOPMENT*. CHAPEL HILL, N.C.: UNIV. OF NORTH CAROLINA PRESS, 1991. XX, 242 P. BIBLIOG. HARDCOVER: $39.95; PAPERBACK: $13.95.

Contrary to most prevailing assumptions Luger and Goldstein conclude that with the exception of a handful of the older facilities, including those at Triangle Park in North Carolina, Stanford in California, and the University of Utah, most of the 116 existing research parks have not automatically equated with economic growth and new job generation. Luger and Goldstein, both professors of regional planning, suggest poor planning and weak leadership often results in only modest success, especially in the face of established concentration of firms surrounding the older R&D parks. Following several chapters that analyze the broader relationships between economic growth and the development of research parks, the authors focus on case studies of the above three examples. Finally, they analyze the reciprocal relationships between research parks and associated universities, concluding that while there is still a role for the latter, it may well be more appropriately focused in such areas as joint research with industry

or small business assistance. This may well especially be the case with newly planned research parks whose chance of success is relatively low, and especially so in areas not already "richly endowed with the resources that attract highly educated scientists and engineers" (p. 184).

SMITH, BRUCE L. R. *AMERICAN SCIENCE POLICY SINCE WORLD WAR II.* WASHINGTON, D.C.: BROOKINGS INSTITUTION, 1990. · IX, 230 P. HARDCOVER: $34.95; PAPERBACK: $14.95.

Bruce Smith's overview of U.S. science policy since World War II will make an excellent text for a wide range of interdisciplinary STS courses. Although clearly the American government has long been involved with science and technology, it has only been in the last half-century that "science policy" has emerged as a distinctive "focus of thought and action." Smith periodizes the last four decades following the wartime reassessment of science and technology into three major phases. The first ran from about 1950 when the postwar system based on Vannevar Bush's *Endless Frontier* and extensive federal support of research was put in place to about 1966. At this point a slowing of federal support for scientific research was accompanied by a questioning of the "dangerous side effects of technology." It was during this period of increased environmental consciousness, consumer and worker safety concerns, and anti-war activism, that not only emerged such federal institutions and policies as the EPA, OTA, and OSHA, and the Clean Air and Water Acts, but also the field of Science, Technology and Society Studies itself. Beginning approximately in 1977, the middle of the Carter administration, and accelerating during the Reagan era, federal policy reflected a renewed enthusiasm and "faith in science and technology." Following two introductory chapters that provide the background for this periodization, Smith focuses the largest part of his attention on this tripartite division seeking to explain the relative balance between the promotion of scientific discovery and technological innovation, the regulation of potential negative impacts and "the coordination of policies and programs...to achieve the appropriate balance between nurture and restraint" (p. 6). In his concluding chapter, "The Unfinished Agenda," Smith suggests "the nation has generally been well served by the system of determining science policy" (p. 159). Nonetheless, questions remain, including for example, the appropriate balance between civilian and military R&D, the prioritization of federal resource allocations, the strengths and capabilities of both federal and university research labs, and the role of science in regulatory decision making. Smith believes we need "a greater coherence and rationality" in our science policy in the form of an "inclusive" controlling vision that "place[s] science and technology within the context of the basic directions of public life..."(p. 191).

Readings That Help

This section of the *STS Newsletter* is meant to guide the reader to books or articles that someone recommended to me because they are useful, provocative, or enjoyable--at best, all three. Suggestions of other materials to be reviewed would be most welcome, with or without comments. But I hope you will feel free to comment on my opinions as well.

Barrett Hazeltine
Associate Dean of Engineering, Brown University, Providence, RI 02912

GILOVICH, THOMAS. *HOW WE KNOW WHAT ISN'T SO: THE FALLIBILITY OF HUMAN REASON IN EVERYDAY LIFE.* NEW YORK, N.Y.: FREE PRESS, 1991. 194 P. PAPERBACK: $19.95.

The first few sentences say it nicely: "It is widely believed that infertile couples who adopt a child are subsequently more likely to conceive than similar couples who do not. The usual explanation for this remarkable phenomenon involves the alleviation of stress.... On closer inspection, however, it becomes clear that the remarkable phenomenon we need to explain is not why adoption increases a couple's fertility; clinical research has shown that it does not. What does need explanation is why so many people hold this belief when it is not true." Part of the explanation may be a misunderstanding about random data--a belief, essentially, that a truly fair coin would alternate heads and tails. Another part may be undue attention to confirmatory data--admissions officers at selective colleges only see the performance of admitted students, nearly all of whom do well. A third part may be biased evaluation of data, especially incomplete data--"I'll see it when I believe it." Other parts may be motivational and social (the author is a psychologist): seeing what we want to see, believing what we are told rather than what we observe--i.e., believing that "One in five Americans will have AIDS" when we may not know even one AIDS victim, or imagining that others agree--an explanation for why Kennedy's advisors did not stop the Bay of Pigs fiasco. Three examples, "alternative" health practices, ESP, and personal behavior in groups, are analyzed. I was not surprised to learn that the number of

astrologers in this country is twenty times the number of astronomers but was surprised to learn that more people believe in ESP than evolution. The book concludes with a charge to social scientists to offer to their students and the general public an understanding of why we know what isn't so.

MAGAZINER, IRA C. AND MARK PATINKIN. *THE SILENT WAR: INSIDE THE GLOBAL BUSINESS BATTLES SHAPING AMERICA'S FUTURE*. NEW YORK, N.Y.: RANDOM HOUSE, 1989. 307 P. PAPERBACK: $14.95.

"World business success stories...share the same four elements: technological leadership, a skilled work force, strong exports, and a solid local production base able to take a long term view." Three of the success stories are U.S. companies: General Electric which turned around their home appliance business by focusing on manufacturing; A.T. Cross which prospered by exporting; Corning Glass which dominated the fiber optics industry through research and a willingness to expand production in anticipation of demand. A Korean success story is microwave ovens--a third of the U.S. market, including ovens with the G.E. label, is supplied from Korea. A Japanese success story is photovoltaics--a product targeted by MITI (Ministry of International Trade and Industry). A German success story is a machine tool company which recognized early that their future was in computerized models. Magaziner and Patinkin are clearly worried and give specific recommendations. What could be a dull subject lives because the story describes real people, and the less exciting material is in the notes. Lots of people would benefit from this book, including those who think technology and production can be afterthoughts for American business.

MOKYR, JOEL. *THE LEVER OF RICHES*. NEW YORK, N.Y.: OXFORD UNIV. PRESS, 1990. 304 P. HARDCOVER: $24.95.

"Why does technological change occur in some societies and not in others?" China before 1400 was, as well as these things can be measured, technologically superior to Europe and was moving at least as fast. In the next three centuries or so, this technological momentum ceased and Europe came to lead. Why? Technological innovation in medieval Europe achieved much more than in classical Greece and Rome despite the evident intellectual superiority of classical society. Why? Why did the Industrial Revolution take place in Britain rather than continental Europe? Was it that people lived longer? that nutrition was better? that the geography was more favorable? that science was stronger? that religion was less conservative? that the patent system was more supportive? that wars took place (or did not take place?) The best that can be said is that the evidence is murky. A major part of the book is a review of technological change from classical times to 1914. One chapter discusses technological change from an economic perspective. Another develops the analogy between biological evolution and technological change. The question is important. The exposition is thorough and lucid. The reader comes away with much to ponder.

RYBCZYNSKI, WITOLD, *TAMING THE TIGER*. NEW YORK, N.Y.: VIKING, 1983. 227 P. BIBLIOG. PAPERBACK: $8.95.

The tiger to be tamed is technology--"we must learn to live with the machine; we have little other choice." That tiger is blamed for sweatshops, nuclear weapons, homogenization of national cultures, and more. Attempts to reject technology--Luddites smashing looms (actually it is pointed out that the situation was more complicated than generally appreciated), nations uninventing foreign technology as in Cambodia in 1975 and Madagascar in 1820, Sioux ghost dancers discarding metal tools and ornaments--have not succeeded. Technology is tamed, controlled, by the actual design of the device--air bags and seat belts save lives. It is controlled by the choice of whether to use it--poison gas has been employed sparingly since WW I and Japanese nobles chose to use swords rather than guns in the seventeenth century. A final way of control is how technology is used. Migrants to third world cities build their own housing from what is available--reinforced concrete, cement blocks, and corrugated iron sheets. The examples, if nothing else, keep one reading, but nearly every page has significant insights. Not much in the book about pollution or mindless sitcoms on TV--technology run amuck--but a clear recognition "that the struggle to control technology has all along been a struggle to control ourselves."

SCHNAARS, STEPHEN P. *MEGAMISTAKES: FORECASTING AND THE MYTH OF RAPID TECHNOLOGICAL CHANGE*. NEW YORK, N.Y.: FREE PRESS, 1989. 185 P. HARDCOVER: $24.95.

Megamistakes complements *How We Know What Isn't So* (see Gilovich above) well because it deals

with forecasts, nearly all of which turned out false--quadraphonic stereo was withdrawn from the market after a few years, Dupont's miracle fiber Kevlar has not yet found a major market, automated vehicle separation on Interstates by 1979 was forecast in 1966. Why do forecasters go wrong? Perhaps because of infatuation with state-of-the art technology, perhaps by disregarding price/performance analysis, perhaps being linked by optimism or the highly visible technology of the day--in the 1960s nuclear power was expected to propel ships and planes, dig highway foundations, energize cordless appliances. The author claims the book is entertaining but "tells an important tale based on a reading of actual past forecasts." For my taste the entertainment won out, but, at the least, many instructive examples are gathered in one place. I do agree that improved forecasts will come from better understanding of the situation rather than more sophisticated mathematics.

WATTENBERG, FRANK. *PERSONAL MATHEMATICS AND COMPUTING*. NEW LIBERAL ARTS SERIES. CAMBRIDGE, MASS.: MIT PRESS, 1990. 482 P. APPENDICES. HARDCOVER: $29.95.

Two of the aims of the Alfred P. Sloan Foundation's New Liberal Arts Program are familiarity with computers and facility in quantitative reasoning. *Personal Mathematics and Computing* addresses both aims. The heart of the book is the application of mathematics and computing to several real problems. Perhaps the major problem addressed is the distribution of state financial aid to cities and towns. The analysis is based on actual data for Massachusetts--population and per capita equalized property valuation. The reader is expected to construct computer programs, with a good deal of guidance, which test, for example, the equity of various distribution formulae. The explanations and rationale for these formulae are especially clear. Another major problem addressed is population models. A typical question is how the population of two species vary when they compete for food. Optics and economic models are also treated. The computing is done with True BASIC, which is explained in the body of the text, supplemented by a Reference Manual in the Appendix. A person mastering the material, which seems a reasonable goal for most people, would have both the confidence and the background to analyze critically proposals and behaviors described by numbers. Our society needs more such people.

WOLFSON, RICHARD. *NUCLEAR CHOICES: A CITIZEN'S GUIDE TO NUCLEAR TECHNOLOGY*. NEW LIBERAL ARTS SERIES. NEW YORK, N.Y.: MCGRAW-HILL, 1991. 462 P. PAPERBACK: $24.95.

Nuclear reactors produce an appreciable part of our electrical power without warming the globe. Nuclear technology is important in medicine, in archaeology, in food processing, and more. The potential devastation from nuclear warfare is essentially incomprehensible. A nuclear accident would have serious health consequences for thousands of people, but it is much more likely that a person would die in an automobile accident than in a nuclear accident. The premise of this book is that the citizen making (or at least influencing) choices about nuclear technology should base those choices on understanding. The first section deals with the physics and technology of nuclear fission and fusion, the second section with nuclear power, and the third with nuclear weapons. The exposition is especially readable for several reasons. One is the use of comparative measures--a single B-52 carries more explosive power, in the form of nuclear weapons, than was released in all of World War II. A flashlight uses about 1/50 of the power the human body can produce, a small car going at 60 miles per hour uses 800 times as much. A second reason the reader becomes involved is frequent and evenhanded references to news articles, chiefly from the *New York Times* about nuclear issues. A third reason is the scope of the coverage, which includes, among much else, a description of how SDI is to operate and an analysis of alternative (to nuclear fission) energy sources. Highly recommended for its clarity, for its fairness in giving several points-of-view, and for the amount a reader learns.

ZUBOFF, SHOSHANA. *IN THE AGE OF THE SMART MACHINE: THE FUTURE OF WORK AND POWER*. NEW YORK, N.Y.: BASIC, 1988. 414 P. PAPERBACK: $11.95.

"Are we all going to be working for a smart machine, or will we have smart people around the machine?" As manufacturing and office work become integrally based on computers, will jobs be enriched or stultified? The field work for this book was done principally at two paper mills (one modernized, one brand new), the dental claims office of an insurance company, an international bank implementing an extensive data base system, and a utility assigning maintenance workers through a computer. The discussion, which is serious scholarship, deals with how jobs and management theories have changed

since the Middle Ages, fundamental differences between the mental processes used by those who physically handle machinery or written records and those who watch a computer screen, and the basis of authority in an organization. It is clear that, if this new technology is to realize its potential, new relationships within organizations will be needed, as well as new perceptions. Another quotation demonstrates the theme and speaks to a central purpose of the *STS Newsletter*. "History reveals the power of certain technological innovations to transform the mental life of an era--the feelings, sensibilities, perceptions, expectations, assumptions, and above all, possibilities....An important technological innovation can be seen as an alternation of the material horizon of our world with transformative implications for both the contours and the interior texture of our lives."

OTHER WORKS RECEIVED

FINN, BERNARD S. *THE HISTORY OF ELECTRICAL TECHNOLOGY: AN ANNOTATED BIBLIOGRAPHY.* BIBLIOGRAPHIES OF THE HISTORY OF SCIENCE AND TECHNOLOGY, VOL. 18. NEW YORK, N.Y.: GARLAND, 1991. XVI, 342 P. ILLUS. HARDCOVER: $48.00.

Over 1500 annotated entries covering books, articles, and dissertations, mostly in English and published since 1850, arranged by subject, with name and subject indexes. Another fine volume in an excellent series.

MARVIN, CAROLYN. *WHEN OLD TECHNOLOGIES WERE NEW: THINKING ABOUT ELECTRICAL COMMUNICATION IN THE LATE NINETEENTH CENTURY.* NEW YORK, N.Y.: OXFORD, 1988. 269 P. ILLUS. PAPERBACK: $12.95.

A wide-ranging analysis of how two late 19th-century electrical technologies--incandescent lighting and the telephone--were envisioned in terms of their development, adoption, and use. An interesting contextual history that could be utilized in a variety of STS-related history, communications, and media courses.

OLNEY, MARTHA L. *BUY NOW, PAY LATER: ADVERTISING, CREDIT, AND CONSUMER DURABLES IN THE 1920S.* CHAPEL HILL: UNIV. OF NORTH CAROLINA PRESS, 1991. XVII, 424 P. BIBLIOG. HARDCOVER: $45.00.

Olney examines the dramatic expansion of consumer spending on household durables, especially as related to increasingly available retail credit and new advertising promotions, which were more the result of production and financial concerns, rather than deliberate marketing efforts. Extensive tables and figures.

WAGAR, W. WARREN. *THE NEXT THREE FUTURES: PARADIGMS OF THINGS TO COME.* WESTPORT, CT.: PRAEGER, 1991. XXI, 165 P. BIBLIOG. HARDCOVER: $45.00; PAPERBACK: $14.95.

Wagar summarizes and synthesizes various aspects of futures study by examining how futurists pursue their work, especially with respect to the environment, economics and politics, war and peace, and social-cultural issues. He utilizes three futurist paradigms based on current ideological perspectives, those of the "technoliberals," "radicals," and "counter culturalists."

WARING, STEPHEN P. *TAYLORISM TRANSFORMED: SCIENTIFIC MANAGEMENT THEORY SINCE 1945.* CHAPEL HILL: UNIV. OF NORTH CAROLINA PRESS, 1991. XI, 288 P. BIBLIOG. HARDCOVER: $34.95.

Following an introductory background chapter, Waring focuses on management theories and techniques pursued by the post-WW II intellectual descendants of Frederick Winslow Taylor who transcended his techniques, but not his principles. He devotes specific chapters to the development, content, influence, and response to quantitative operations research and management science, the bureaucratic rationality of Herbert Simon, management by objectives, sensitivity training, job enrichment, and quality control.

WORLDWATCH PAPERS

JACOBSON, JODI L., *WOMEN'S REPRODUCTIVE HEALTH: THE SILENT EMERGENCY.* NO. 102, 70 P.

DURNING, ALAN B. AND HOLLY B. BROUGH, *TAKING STOCK: ANIMAL FARMING AND THE ENVIRONMENT.* NO. 103, 62 P.

RENNER, MICHAEL, *JOBS IN A SUSTAINABLE ECONOMY.* NO. 104, 58 P.

LOWE, MARCIA D., SHAPING CITIES: THE ENVIRONMENTAL AND HUMAN DIMENSIONS. *NO. 105, 69 P.*

LENSSEN, NICHOLAS, NUCLEAR WASTE: THE PROBLEM THAT WON'T GO AWAY. NO. 106, 69 P.

Available from Worldwatch Institute, 1776 Massachusetts Ave., NW, Washington, D.C. 20036. Cost $5.00 each.

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Science, Technology & Society is a newsletter devoted to the general area of science, technology, and society studies. It is a joint project of the Lehigh University STS Program and the Technology Studies Resource Center and publishes short articles on the theoretical and speculative aspects of curriculum development, in-depth program and course descriptions, reviews of texts and audio-visual aids, and an annotated bibliography of current books and articles. An "Open Forum" section exists for readers with questions, comments or announcements regarding STS activities or needs. Our goal is to help generate new courses, and provide an information exchange, in the STS field.

Subscriptions, covering six issues, are available for $8.00 per year. Back issues are available for $1.50 each.

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Science, Technology & Society

Curriculum Newsletter of the Lehigh University STS Program & Technology Studies Resource Center

Guest Editor: John A. Schumacher
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No. 88/89, February/April 1992
ISSN: 0275-8075

SCIENCE AND TECHNOLOGY STUDIES– RENSSELAER POLYTECHNIC INSTITUTE AN UNDERGRADUATE PROGRAM PROFILE

The current problems of our technological society can be adequately addressed only by a multi-disciplinary methodology. This methodology also cannot be a patchwork in which the various traditional, disciplinary methodologies work along side of each other but not with each other, as an integrated team, so to speak. The aim of Rensselaer's undergraduate major in STS, officially recognized by the New York State Education Department in 1985, is to lay the groundwork for such a multi-disciplinary methodology.

Why was this particular major developed at Rensselaer? On the one hand, many of its developers had originally been educated in traditional disciplines of science or engineering, and had subsequently realized that they needed to switch into some humanities or social science discipline that would allow them to focus their graduate study on science or technology. But, for a variety of individual reasons, each ultimately realized as well that this new disciplinary focus should not completely exclude the original discipline. The problems they wished to address struck them as defying traditional disciplinary boundaries.

On the other hand, Rensselaer itself strongly emphasized the disciplines outside of the School of Humanities and Social Sciences. The developers of the STS major realized that, like themselves, their students would be more likely to be recognized as authorities by scientists and engineers if they were not only technically literate, but also technically competent, at least to the extent of displaying some grasp of the deeper aspects of a science or engineering education. But once again, this technical competence was taken in a multi-disciplinary way, so that it would undergo a kind of metamorphosis in becoming an aspect of an STS undergraduate education.

Well, that was the aim, the ideal, the developers had in mind. Many of them had benefitted from working together for nearly a decade in Rensselaer's Center for the Study of the Human

Dimensions of Science and Technology, which offered a Master's degree in STS as early as 1974. Incorporating the Center, the Department of Science and Technology Studies was created in 1982, essentially for the same reasons as the undergraduate major itself was initiated three years later. In 1988 New York also officially recognized Rensselaer's Ph.D. degree in STS, and the growing graduate community has now begun to enrich the undergraduate major program.

Certainly in broad outline the existing major curriculum is a success. No profile would be very helpful, however, if it did not discuss the problems that remain to be resolved. But first let us turn to an outline of the basic structure of the curriculum, and a sketch of its major options. As the basis for the STS component of the major curriculum, the curriculum includes a technical component, a H&SS component, and free electives. See Figure 1 below.

The technical component comprises a little more than a third of the curriculum, which totals 124 credit hours. Building on the Rensselaer physical, life, and engineering sciences requirement, the Technical Option requires an STS student to achieve the advanced undergraduate level in some area of science, engineering, or management. The free electives may also be used in the same way, especially if a STS student wishes to prepare for a more technical career or graduate school: for example, a more extensive biology minor to prepare for medical school.

Figure 2 on the following page outlines the STS Component itself. *Introduction to STS* is a 100-level, introductory course. This course is also open to non-STS majors, as are all of our courses now, except for the *STS Seminar*, which is discussed below. The five perspectives courses are 200-level courses that introduce students to more traditional disciplinary perspectives included within the STS Department, though none of them is taught without some multi-disciplinary aspect:

1. *Cross Cultural Perspectives on Science and Technology;*
2. *History of Science and Technology*;
3. *Philosophy, Science, and Technology*;
4. *Politics of Science and Technology*; and
5. *Social Effects of Science and Technology*.

Typically STS students complete the foundation level of their STS component by taking the 400-level course *Decision-Making* to fulfill their requirement in Research Methods in STS, and a basic statistics course offered by another department, for example, Economics, Decision Sciences, or Psychology. A social psychologist teaches *Decision-Making*, which surveys the influence of mental heuristics and biases, social context, and effect on judgment and choice.

FIGURE 1

Technical Component 43 Credit Hours		**H & SS Component** 24 Credit Hours	**Free Electives** 27 Credit Hours
Rensselaer physical, life, & engineering sciences requirement	Technical Option	Rensselaer humanities & social sciences requirement	Add other minors in any discipline or program, using elective, H & SS, &/or technical components; or extend a minor toward the level of another major
25 Credit Hours	18 Credit Hours	Minor in Economics, Communication, or Philosophy, for example	
Math Option 8 Computing 3 Sc Seq I & II 8 Sc/Math Opt 3 Sc/Math Opt 3	Minor in Biology, Environmental Engineering, or Management, for example		

FIGURE 2

Science and Technology Studies Component 30 Credit Hours			
Introduction to STS	3	Advanced STS Option STS focus, to be related to technical option and other minors	9
Two of the Five Perspectives Courses	6		
Research Methods in STS	3	Public Service Internship	3
Statistics Option	3	Senior Project	3

The Advanced STS Option is a set of three related courses, selected with the assistance of a student's advisor, from among the STS course offerings, preferably at the advanced undergraduate or 400-level. These courses should be chosen in conjunction with the set of courses that comprise the student's Technical Option, as well as with the relevant free electives. The same reasoning should also be applied to the student's choice of a public service internship. All of this work forms the foundation for the senior project, in which a STS student, working one-on-one with a professor, explores some area they find particularly interesting.

So, for example, an environmental policy focus can be constructed from a minor in Environmental Engineering or Science, and an Advanced STS Option that includes such STS courses as *Ecology and Society*, *Public Policy and Human Ecology*, *Public Policy and Energy Development*, *World Energy Politics*, and *Risky Technologies*. On this basis, a student can then engage in an internship with a New York environmental agency, and a senior project on the regulation of acid rain or hazardous waste.

Actually, the range of possible foci is so extensive that very few of them have so far been chosen by past and current STS students. The minor in management has become popular as a Technical Option because it is an excellent complement to the STS perspective on science or technology policy, and the School of Management has begun to develop emphases on technology, such as environmental management. A few of our students have used their free electives to minor in management along with a Technical Option in some area of science or engineering. By using the H&SS component to achieve yet another minor in economics or technical communication, an STS graduate is, indeed, in an excellent position to address the current problems of our technological society.

Every Spring semester an STS professor offers a different version of the 400-level *STS Seminar*, which is open only to STS majors. Inasmuch as the STS majors number between 25 and 30 altogether, we encourage all of them to take the seminar every spring, though registration actually averages about fifteen students. The seminar builds a sense of community that would otherwise be lacking in the current STS Program. As the program grows in numbers--to reach the level of 10 to 15 students in each year--other courses could become closed to non-STS majors, and thereby take on some of the seminar's role. The current STS enrollment is at an inflection point, as the program averages from 7 to 10 sophomores, juniors, and seniors, but only a handful at best of first-year students. Most of our students still enter the program after they discover, like many of us did, that they are not really interested in the more narrow perspective of a science or engineering education.

The whole curriculum is successful, however, only if the courses in the Advanced STS Option and the senior project actually achieve some kind of integration of all the other courses, especially the ones in the Technical Option. Although this integration should be the primary responsibility of STS professors, STS students have occasionally displayed their own ability to integrate.

Rebecca Whittemore, a 1991 graduate who now works at Anderson Consulting, was originally studying to be a mechanical engineer, and after her first year she engaged in a regular engineering internship at Digital Equipment Corporation (DEC). In her position as a computer operator, Rebecca observed that poor communication among operators, engineers, and managers was impairing morale and productivity. After switching to STS for her sophomore year, Rebecca was invited back to DEC for another internship, with responsibility for implementing a new production process that management had previously been unable to put in place because of poor communication. By preparing new communication materials that combined technical description of the new process with an appreciation for the operators' perspectives on changes in their work, by organizing staff meetings to discuss the new process, and by breaking down old barriers, Rebecca successfully combined the social and technical aspects of the innovation process.

If all of our students were so able, the Advanced STS Option and the senior project would not have to carry as much of the burden of integration. It is with respect to this burden as well, perhaps because of a diversion of energy to developing the relatively new Ph.D. in STS, that the STS Department continues to face its most serious challenge in moving on to the next stage of development of its undergraduate major. It should also be noted that, because Rensselaer does not make it easy, to put it mildly, for professors from different schools to cooperate in integrating their various disciplines, STS professors currently carry the entire burden of integration in the program.

The current thinking of the department is that we need to develop more 400-level STS courses that can serve as the foci for Advanced STS Options. Two such courses have been *Social Relations of Science* and *Risky Technologies*. The latter is quite popular among STS students because it allows them to achieve an integrated grasp of the political, social, and technical dimensions of civilian technologies that are widely perceived as potentially threatening to human health or the environment. Other courses, such as those mentioned above with regard to constructing a focus on environmental policy, can then extend and/or complement a student's grasp of the political, social, and technical dimensions of risky technologies.

These focusing 400-level courses must also have practical dimensions. Although we are currently beginning to place our graduates such as Rebecca Whittemore in excellent positions, we still need to develop our reputation, and to do so we must be able to point to courses and/or course materials that do, indeed, prepare our students to address the problems of a technological society as we originally aimed for them to do, with a multi-disciplinary methodology. We also need to be able to point to such courses and/or course materials, though in a suitably different way, if we wish to attract more first-year students to major in STS at Rensselaer. We hope our recent advertising efforts will help prospective students, their parents, and their teachers to realize that an education in STS is an education uniquely suited to bringing about a better future for our society.

--John A. Schumacher
Undergraduate STS Program Director
Rensselaer Polytechnic Institut
Troy, New York 12180-3590

COURSE SYLLABUS

INTRODUCTION TO SCIENCE AND TECHNOLOGY STUDIES

1110
Spring 1992

Professors Woodhouse, Bermiss, Layne,
Lytton, McFarland, and Monberg

Course Description:

This course is designed to provide a foundation for more advanced courses for STS majors, minors, and students taking higher-level sequences. It also serves as a self-contained opportunity to think about why humans shape and misshape science and technology the way they do. We intend it to be an enjoyable and stimulating intellectual experience. When it is, let us know; when it is not, also let us know so the course can be improved for the next victims.

What is STS?

The field of Science and Technology Studies has four main concerns:

1. Historical Forces: How and why did technological societies evolve from pre-industrial ones? Who benefitted the most, who was disadvantaged? What human goals and values have been better achieved through science and technology, and which ones have been sacrificed or only minimally achieved?

2. Social Aspects: What are the effects that society experiences from changing scientific ideas and new technological applications? And what effects does society have on science and technology? The intention is to help you learn to think of science and technology as integral parts of society--not as isolated phenomena.

3. Ethical Implications: How should science and technology be used? What is good, and bad, about present and foreseeable future uses? For whose benefit is technoscience now being used? We do not presume that there is a single correct or moral answer, but some opinions are more carefully thought out than others. The intention is to help you think about how your own values are (and are not) being reflected in contemporary technologies.

4. Public Policy: Through what processes are decisions made about science and technology? How might decision-making processes be improved? How does public policy influence the directions taken by science and technology, and how might different policies be developed to achieve human goals more efficiently, or more equitably?

Course Goals and Requirements:

By the end of the Spring term, you will understand why progress in science and technology does not always lead to human betterment. You also will have a clearer idea of whether you think we are using science and technology about as well as humanly feasible. You will have considered, and either accepted or rejected, ideas that several thinkers have proposed for possibly improving technological societies.

The weekly reading assignment will be about 35 to 60 pages, depending on the difficulty of the material. Thursday class sessions will be devoted primarily to arguing about controversial issues in the reading, so it is essential that you complete the assignment carefully before the class at which it is to be discussed.

Because the learning here is based on osmosis from discussions, more than on memorizing, you will need to attend class regularly. If you also participate frequently in class discussions, you will contribute to the group, get your own brain moving, and develop oral/interpersonal skills that can be a significant asset in business as well as in personal life. As discussed below under "grading," there are substantial rewards for regular attendance and for class participation.

Grading:

There is no curve. Last term, about half the class earned A's; in principle, everyone can earn an A this term. That probably will not happen, but our intention is to help you earn whatever grade you want to aim for. Grades will be calculated as follows:

40% Attendance, participation, quizzes. (One unexcused absence without penalty from Tuesday lecture, and one without penalty from Thursday discussion sections. Maximum unexcused absences to pass the course = four Tuesdays and four Thursdays. Seniors beware.)

25% Journals.

15% Take-home midterm exam/paper.

20% Take-home final exam/paper.

Extra credit: Negotiate with your section leader. Can include recommended readings, short papers on a topic of your choice, group projects, interviews of RPI faculty.

Journals:

Your main written work will be a weekly commentary on the readings, based in part on questions we will provide. The intention is simply to make sure you have grasped the main points of the readings, and to give you a chance to develop your own ideas about some of the subjects covered. You are free to ramble, change your mind in mid-thought, and otherwise treat the work as an opportunity for dialogue with yourself; we are not looking for polished essays. Word processing is strongly preferred; but if it is a lot easier for you to write longhand, work it out with your discussion section instructor.

Journals are due at the beginning of class most Tuesdays, starting on January 21 and ending on April 14. (There is no journal due on March 3, or on March 10 [Spring break]). And you may skip any two of the assigned journals without penalty--during GM week, for example. (Extra credit for

those who choose to skip only one, or none.) Late journals incur a penalty, but will be accepted, except that all journals from the first half of the course must be handed in no later than the day after Spring break.

Take-Home Exams/Papers:

A midterm exam/paper of approximately five pages is due on Thursday, March 5, just before Spring break. A final exam/paper of about seven pages is due on Wednesday, April 29. Further details will be provided as those dates approach.

Quizzes:

A brief quiz after the lecture/film most Tuesdays is intended to serve three functions: to help fix your attention on the material being presented that day; to make sure you get credit for having attended the class; and to guide the instructors in determining what material needs to be discussed at the Thursday discussion section, or reiterated in lecture the following week.

Books:

Brown, Lester et al., *State of the World 1991* (New York: Norton, 1991).

Volti, Rudi, *Society and Technological Change* (New York: St. Martin's Press, 1988).

Introductory STS Readings: purchase at STS Department Office, Sage 5116. Cost: $24.00 (for xeroxing and permission fees to publishers).

Course Difficulty and Workload:

This course is designed to be of moderately low difficulty, but to demand steady work. Readings are shorter and easier to understand than in many H&SS courses, and there is not much you have to memorize. But assignments are due just about every week, so it is not a course you can blow off for an extended period, then cram. A steady 4-5 hours of homework weekly, coupled with regular class attendance, should yield an A or B grade for most students.

Gender-Fair Language:

Gender-fair language is expected in your writing and speaking. If you need assistance with it, your discussion section instructor will be glad to help.

Academic Honesty:

Penalties for cheating are brutal, ordinarily failure in the course. Outside class, it is fine to discuss anything with your colleagues (or anyone else), including getting feedback about spelling/grammar/phrasing or your substantive ideas. But all the actual writing must be your own. If you have any questions about this, now or later, please ask. Sorry to be so harsh, but we do not want to leave any room for doubt.

Who's Course Is This, Anyway?

If you see some way to modify one or more assignments to better suit your needs, please see what you can work out (in advance) with your discussion section instructor. To the extent feasible, we would like this to be your course as much as ours.

Sample Readings and Discussion Questions:

Housing and Household Technologies

Readings:

1. Kenneth T. Jackson, "Crabgrass Frontier: The Suburbanization of the U.S.," Chapter 9 in Randall E. Stross, ed., *Technology in Society in Twentieth Century America* (Chicago: Dorsey Press, 1989).
2. Ruth Schwartz Cowan, "More Work for Mother," Chapter 13 in Stross.
3. Moyra Dooly, "A Woman's Place: Dolores Hayden on the 'Grand Domestic Revolution'" (xerox).

Recommended (extra credit):

4. Daniel Boorstin, "The Americans," Chapter 1, pages 7-18 only, in Stross.

Discussion Questions:

1. List as many factors as you can that help shape the way housing and household technology are designed and used. Have any of these shown up in other areas of technology we have examined in previous weeks?

2. What do you consider the main shortcomings of the way cities and suburbs now are laid out? If you were redesigning the way that houses, businesses, streets and so forth were laid out, what are some of the changes you might seriously consider?

3. To what extent is housework gendered in your household? How was the pattern decided upon?

4. Did the technical innovations known as suburbs and modern appliances result in happier people? What seems to be required for innovation to really add to the quality of people's lives?

Energy/Environment/Risk

Film: "The Battle for Wilderness."

Readings:

1. "Chief Seattle's Message" (xerox).
2. Langdon Winner, "The State of Nature Revisited," Chapter 7, in *The Whale and the Reactor* (Chicago: Univ. of Chicago Press, 1986), pages 123c-134b only.
3. Alan Durning, "Ending Poverty," in *State of the World, 1990* (Washington, D.C.: Worldwatch Institute, 1990).

Recommended (extra credit):

4. Take a half-hour walk in as natural a setting as you can conveniently locate. Prospect Park? Notice how your experience ties in with this week's theme, or with the course more generally.

Discussion Questions:

1. Many students have expressed the idea that it is only "human nature" to behave in the self-interested ways that many modern Americans do. How does Chief Seattle's message challenge this view? More generally, what does this reading contribute to understanding how humans can use technology in ways we will find fulfilling?

2. What are the three ways of viewing nature that Winner discusses? Is there one of these ways you consider superior to the others, or some combination? Why?

3. What are some of the connections between poverty and environmental degradation? Is there potentially enough for all humans, or must we disadvantage others to protect ourselves?

Extra Credit:

4. Describe some of what you experienced on your walk. If you could have walked in Yosemite for a week instead of Troy for half an hour, how might your experience have been different?

COURSE SYLLABUS

CROSS-CULTURAL PERSPECTIVES ON SCIENCE AND TECHNOLOGY

2530
Spring 1992

David J. Hess

Course Description:

This course considers science and technology from a cultural perspective, with emphasis on the colonial legacy in the Third and Fourth Worlds. We consider how to interpret science and technology from a cultural perspective; how science and technology have played a role in colonialism and neocolonialism; how local communities in the Third and Fourth Worlds resist technocolonialism; and how scientists and engineers might reappropriate science and technology to help empower marginalized peoples and cultures, both at home and abroad.

Books for Purchase:

Raymonde Carroll, *Cultural Misunderstandings*. Carol Volk, trans. (Chicago, Ill.: Univ. of Chicago Press, 1990).
Andrew Revkin, *The Burning Season*. (Boston, Mass.: Houghton Mifflin, 1990).
Julian Burger, *Report from the Frontier: The State of the World's Indigenous Peoples*. (Atlantic Highlands, N.J.: Humanities, 1987).

Requirements and Grading:

I grade on a straight curve: 90-100 is an A, 80-89 is a B, 70-79 is a C, and 60-69.9 is a D. I grant incompletes only if you come to me well before the end of the semester and you have a good reason in accordance with the guidelines issued by the Registrar's Office (e.g., illness, family emergency, etc.).

20% Class participation and attendance. (I will deduct two points from the 20 allotted for each unexcused day of class absence. If you will be sick, at an interview, or on a plant trip, leave a message on my phone or with the department secretary, 6-6444, before the class.)

30% Discussion Preparation Assignment (5 points each). These should be one page, single-spaced, and typed (or the equivalent if handwritten). The discussion assignment represents your opinion, and it is meant to prepare you for class discussion. You will be graded on thoroughness and timeliness, not whether you are "right" or "wrong." Assignments are due in class; late assignments will lose points (approximately two per week).

30% Quizzes on reading and class lectures/discussions. There will be four quizzes (@ 10 points), each of which is listed in the syllabus. There will be no pop quizzes. There are no make-ups, but you may drop the lowest of your four quiz grades.

20% Final paper (7 pages, double-spaced). A library research paper in which you consult at least two books or six articles and discuss some aspect of science and technology considered in the course. You will meet with me individually to go over your paper.

The following will be considered instances of academic dishonesty: copying a homework assignment, paper, or quiz question from another student; recycling one's own or others' papers from other courses; direct quotation from printed sources without providing a citation (including rewording or "patchwork plagiarism"); and the use of specific ideas and interpretations of printed sources without citation ("theft of ideas").

I will expect your papers to be written in a gender-free style; see the "Generic He-Man" handout available from the Writing Center on the fourth floor of the Sage Building.

Course Outline and Readings:

I. SCIENCE, TECHNOLOGY, AND THE CULTURE CONCEPT

1/14 **Introduction.** Discussion of the course outline and expectations, cultural anthropology, and the culture concept.

1/16 **Lecture/Discussion:** *A Cultural Critique of the Scientific Revolution.*
Reading: Carroll, *Cultural Misunderstandings*, pp. ix-21.
Reading on Reserve: "The Origins of Western Science," unpublished manuscript.

1/21 **Lecture/Discussion:** *Cultural Construction of Science & Technology* (Pt.1--theories; Pt.2 --spaces).
Reading: Carroll, *Cultural Misunderstandings*, pp. 22-58.
Reading on Reserve: Hess, "The Cultural Construction of Scientific Theories," and "Spatial Organization and Values in Two American Campuses," unpublished manuscript.

1/23 **Discussion of Discussion Preparation Assignment #1.** (5 Pts.):
Apply one episode of *Cultural Misunderstandings* to possible misunderstandings that might emerge between scientists and engineers from different countries. You may select an episode from the reading assignment for 1/16, 1/21, or 1/23.
Reading: Carroll, *Cultural Misunderstandings*, pp. 58-88.

1/28 **Lecture/Discussion:** *Science, Technology, and Natural Cultures.* Case I: Japan.
Reading: Carroll, *Cultural Misunderstandings*, pp. 88-110.
Reading on Reserve: Hess, "East/West, North/South" (the part on Japan), unpublished manuscript.

1/30 **Lecture/Slides/Discussion:** *Science, Technology, and Natural Cultures.* Case II: Brazil.
In-class reading of "Domestic Technology in Brazil and the United States."
Reading: Carroll, *Cultural Misunderstandings*, pp. 110-24.
Make-Up Reading on Reserve: Hess, "East/West, North/South" (the part on Brazil), and "Domestic Technology in Brazil and the United States," unpublished manuscript.

2/4 **Quiz #1** (15 Pts.): On reading, lectures, and discussions for Part I of the course, including reading for today. The quiz will be followed by discussion of reading, so bring the book with you to class.
Reading: Carroll, *Cultural Misunderstandings*, pp. 124-end.

II. SCIENCE, TECHNOLOGY, AND COLONIALISM: CASE STUDY OF THE AMAZON

2/6 **Lecture/Slides/Discussion:** *Introduction to Brazil.*
Reading: Revkin, *The Burning Season*, pp. 1-38.

2/11 **Lecture/Discussion:** *Introduction to Political Economy of Colonialism.*
Reading: Revkin, *The Burning Season*, pp. 39-97.

2/13 **Video on the Amazon, followed by discussion:**
Reading: Revkin, *The Burning Season*, pp. 98-149.

2/18 **Lecture/Discussion:** *Technologies of Culturecide*
(Micro/macro technologies, proletarianization, tourism.)
Reading: Revkin, *The Burning Season*, pp. 150-84.

2/20 **Video on the Amazon, followed by discussion:**
Reading: Revkin, *The Burning Season*, pp. 185-230.

2/25 **Lecture/Discussion:** *Technology and Gendered Disempowerment.*
Discussion Preparation Assignment #2. (5 Pts.):
Write on any issues having to do with gender and disempowerment that you saw in the movies or in the book. We will discuss your assignment in class.
Reading: Revkin, *The Burning Season*, pp. 231-55.

2/27 **Quiz #2** (15 Pts.) on Part II of the course, both reading and class lectures/discussion. The quiz will be followed by a discussion, so bring *The Burning Season* to class.
Reading: Revkin, *The Burning Season*, pp. 278-98.

III. SCIENCE, TECHNOLOGY, AND LOCAL RESISTANCE

3/3 **Lecture/Discussion:** *Resistance Strategies within the Political Process.*
Reading: Burger, *Report from the Frontier*, pp. 1-16. (Chpts. 1 & 2), pp. 177-208 (Rich Countries).

3/5 **Lecture/Discussion on Media/Public Education Strategies.**
Video: on Kayapó and Resistance Strategies.
Reading: Burger, *Report*, pp. 88-116 (South America).

3/10-12 Spring Break

3/17 **Video (continued)**: on Kayapó and Resistance Strategies.
Followed by class discussion of video and discussion topic.
Discussion Preparation Assignment #3 (5 Pts.): Make a list (referenced by tribe and page number) of all the resistance strategies you have seen described in the book (including the reading for today), and crosslist the strategies by country.
Reading: Burger, *Report*, pp. 63-76 (Mexico & Central America).

3/19 **Lecture/Discussion**: *Sabotage and Armed Resistance.*
Reading: Burger, *Report*, pp. 117-58 (Asia), pp. 235-45 (Miskitos).

3/24 **Lecture/Discussion**: *Emigration.*
Reading: Burger, *Report*, pp. 76-85 (Guatemala), pp. 162-74 (Africa).

3/26 **Lecture/Discussion**: *Transnational Coalition Politics.*
Discussion Preparation Assignment #4 (5 Pts.): Using everything you have read in Burger and discussed in class, which resistance strategies do you think work best (and why/when)?
Reading: Burger, *Report*, pp. 52-61 (Fighting Back), and pp. 262-82 (Chpts. 13-14).

3/31 **Quiz** (15 pts.) on part III of the course, including class lectures, movies, discussions and reading (including reading for today). The quiz will be followed by a discussion.

IV. RECONSTRUCTING SCIENCE AND TECHNOLOGY

4/2 **Lecture/Discussion**: *Feminist and Ethnic Reconstructions of Science.*
Reading: Sandra Harding, *The Science Question in Feminism* (Ithaca, N.Y.: Cornell Univ. Press, 1986), Chs. 3 and 4, pp. 58-110). This book is on reserve for my other course, *Research Methods in STS*, 51-6110. This is a longish assignment,but there is no reading assignment for the seventh.

4/7 **Discussion.**
Discussion Preparation Assignment #5 (5 Pts): How would issues of gender or ethnicity influence how you might redesign spaces, institutions, theories, or technologies, either here at Rensselaer or in the "real world"?

4/9 **Lecture/Discussion**: *Third World Reconstructions of Science (including the Green Revolution).*
Reading: Sam Bass, "The Dudu World," in *Camping with the Prince and Other Tales of Science in Africa* (Boston, Mass.: Houghton Mifflin, 1990).

4/14 **Lecture/Discussion**: *Reconstruction and Native Ways of Knowing.*
Discussion Preparation Assignment #6 (5 Pts.): You have just received a ten million dollar grant to design a project that you would manage and run in order to help a community in the Third World. If relevant, draw on your skills as a scientist, engineer, manager, architect, etc.

4/16 **Lecture**: *Working with Local Communities for Empowerment (some examples and lessons).*
Discussion continued of assignment #6.

4/21 **Quiz #4** (15 Pts.):
On readings and class discussions, lectures, etc. for Part IV.

4/23-4/28 **Individual Meetings.** Bring the rough draft of your paper with you to review with me (or at least the first paragraph and an outline). This is a required meeting; failure to make an appointment or to show up will affect the grade on your paper.

Final paper due no later than 4 p.m., Wednesday, May 3, in my mailbox or office.

COURSE SYLLABUS

HISTORY OF SCIENCE AND TECHNOLOGY

2120-01/02
Fall 1991

P. Thomas Carroll
Teaching Assistant: Diane Cassidy

Course Description: In mid-twentieth-century America, people tended to think that we had superior knowledge of, and command over, nature, and that we were better off for it. Consequently, studying the history of our science and technology seemed silly, an exercise in learning about the mistaken ideas our ancestors had. Recent scholarship, however, reveals a far more complex story. It turns out that the manner by which a society perceives of and manipulates nature is by no means determined entirely by physical laws or human instinct. Consequently, one must study the history of each civilization to understand how its systems of natural knowledge and material culture have evolved. Furthermore, the development of science and technology in a society can produce subtle and unsuspected results. Examination of these issues challenges the student's resourcefulness and encourages self-scrutiny.

This course is designed as a first excursion into the history of science and technology in Western civilization. Although it touches on many of the main episodes in that history, it is not a survey. Rather, it is an initiation into the subject. It aims, first, to awaken you to the insights you can find in this scholarship; second, to familiarize you with some of the major contours of the scholarly literature; third, to outline the development of Western science and technology since the Middle Ages; and fourth, to sharpen your critical perspectives on current science and technology. STS majors wishing to specialize in historical studies should use this as a springboard to more advanced work. Other undergraduates will find that this course will deepen their understanding of their chosen professions and encourage mature judgments concerning the courses their careers take.

Course Texts: Required (available in the Rensselaer Bookstore):

Edward H. Carr, *What Is History?* (Garden City, N.Y.: Anchor, 1977).
James Deetz, *In Small Things Forgotten: The Archaeology of Early American Life* (Garden City, N.Y.: Anchor, 1977).
Thomas P. Hughes, *American Genesis: A Century of Invention and Technological Enthusiasm, 1870-1970* (New York, N.Y.: Penguin Books, 1989).
Evelyn Fox Feller, *A Feeling for the Organism: The Life and Work of Barbara McClintock* (New York, N.Y.: W. H. Freeman & Co., 1983).
Arnold Pacey, *The Maze of Ingenuity: Ideas and Idealism in the Development of Technology* (Cambridge, Mass.: MIT Press, 1976).
Carroll W. Pursell, Jr., eds., *Technology in America: A History of Individual and Ideas* (Cambridge, Mass.: MIT Press, 1981).
William Strunk, Jr. and E.B. White, *The Elements of Style*, 3rd ed., with Index (New York, N.Y.: Macmillan, 1986).

Recommended (strongly so for STS majors; available in Folsom Library):

William F. Bynum, et al., eds., *Dictionary of the History of Science* (Princeton, N.J.: Princeton Univ. Press, 1985).
Paul T. Durbin, ed., *A Guide to the Culture of Science, Technology, and Medicine* (New York, N.Y.: Free Press, 1984)

Assignments and Grades: The grade in this course will derive from six different indicators of your performance: two short surprise quizzes on the readings; a four-page essay; a midterm; a final; and class participation (which will include special preparation for one discussion class, performance as an editor of a classmate's four-page essay, and weekly ungraded written reflections.) At the instructor's option, students with exemplary scores near the end of the semester may be exempted from the final examination.

Unless the class as a whole is not at all average, grading will be adjusted to a normal curve with a mean of B-minus. Cheating on *any* part of the course will constitute grounds for failure of the whole course. In particular, to avoid the charge of plagiarism, place all phrasing not your own, however trivial, within quotation marks, and cite a source of all pages or ideas not your own. Consult the *Rensselaer Handbook* for further information about academic dishonesty. Weighting of the various components of the grade will be as follows:

Quiz (higher score)	5%	Midterm examination	20%
Quiz (lower score)	10%	Final examination	25%
Four-page essay	20%	Class participation	20%

The quizzes will be given in class on unannounced dates. They will be simple tests of your diligence in keeping up with and comprehending the assigned reading. The essay, a four-page typed discussion of one of the class sessions, will serve as an exercise in analytical prose and critical thought. One of four possible due dates will be assigned randomly to each student. The midterm and the final will be more strenuous tests of your ability to integrate the materials of the course into your own critical historical interpretation. They will be in-class, open-notes, closed-book essay exams. (If a majority of the class wishes it, the final will be handed out in advance, and a take-home option may be added for it.) The best preparation for the exams is full and responsible participation in class discussions, which provides an opportunity to subject your ideas to public scrutiny. This is such an important element of history that class participation is factored materially into the grade. The instructor or teaching assistant will be the discussion leader, but once during the semester, each student will help direct the class discussion by being an *agent provocateur*. (A sign-up sheet for these assignments will be available on September 4.) The success of the course depends critically upon each student attending class religiously, completing the readings *before* class, and participating actively in discussions.

Students are also required to submit a page of reflections on the readings at the end of each discussion, and to write an anonymous one-paragraph evaluation of the week's work at the end of that discussion. The number of one-page reflections submitted will be factored into the class participation grade, but the reflections themselves will not be graded; they provide writing practice for the student and allow the instructor and his assistant to monitor progress in the course.

I cheerfully make alternate arrangements for any student whose observation of Rosh Hashanah, Yom Kippur, or other religious or similar events conflicts with the terms of this syllabus. Give me as much notice as you can of your needs, please.

Schedule: Most of the semester will consist of three-class units. In the first class of each unit, the instructor will offer supplementary information and illustrations, then tease out the major themes for discussion. The second class will vary among further lecturing, plenary discussion, and the viewing of films. You will be the major actors for the final, discussion-based class. Readings from sources other than the texts are on reserve in Folsom Library, under the instructor's name.

No./ Dates	TOPICS AND READINGS

1. August 28 — ***Organizational Meeting: Definitions and Objectives.***

2. August 30 — ***What is History?***
   Sept. 4 & 6 Reading:
   Carr, chapters 1 and 4.
   "Prologue: The Strange Death of Silas Deane," in James West Davidson and Mark Hamilton Lytle, *After the Fact: The Art of Historical Detection* (New York, N.Y.: Knopf, 1982), xiii-xxxii.
   Strunk & White, entire.

3. September — ***A Sampler of Curiosities.***
   9, 11 & 13 Reading:
   Lynn White jr., "Death and the Devil," in Robert S. Kinsman, ed., *The Darker Vision of the Renaissance* (Berkeley: Univ. of California Press, 1974), 25-46.
   Robert Darnton, "Workers Revolt: The Great Cat Massacre of the Rue Saint-Séverin," in *The Great Cat Massacre and Other Episodes in French Cultural History* (New York, N.Y.: Vintage, 1985), 74-104.
   J. Bronowski, "Knowledge or Certainty," in *The Ascent of Man* (Boston, Mass.: Little, Brown & Co., 1973), 352-77.

4. September — ***Historiography of Science and Technology.***
   16, 18 & 20 Reading:
   Thomas S. Kuhn, "The History of Science," in *The Essential Tension: Selected Studies in Scientific Tradition and Change* (Chicago, Ill.: Univ. of Chicago Press, 1977), 105-26.
   Arnold Thackray, "History of Science in the 1980s: Science, Technology and Medicine," *Journal of Interdisciplinary History* 12 (1981): 299-314.
   John M. Staudenmaier, S.J., *Technology's Storytellers: Reweaving the Human Fabric* (Cambridge, Mass.: MIT Press, 1985), chapter 1.
   Recommended: browse in Bynum and in Durbin (esp. the chapter by Thackray).

5. September — ***Medieval Technology and The Medieval World-View.***
   23, 25 & 27 Reading:
   Pacey, preface, introduction, chapters 1 and 2.

6. Sept. 30- — ***Scientific Revolution I: The Italian Renaissance.***
   Oct. 2 & 4 NOTE: Group 1 essays due at end of this unit.
   Reading:
   P. M. Harman, *The Scientific Revolution* (New York, N.Y.: Methuen, 1983), entire.
   Richard Westfall, "Science and Patronage: Galileo & the Telescope," *Isis* 76 (1985): 11-30.
   Pacey, chapter 4.

7. October — ***Scientific Revolution II: The English Civil War.***
   7, 9, & 11 NOTE: Group 2 essays due at end of this unit.
   Reading:
   Margaret C. Jacob, *The Cultural Meaning of the Scientific Revolution* (Philadelphia, Pa.: Temple Univ. Press, 1988), chapter 3.
   Carolyn Merchant, *The Death of Nature: Women, Ecology, and Scientific Revolution* (New York, N.Y.: Harper & Row, 1980), chapter 12.
   Recommended: Charles Webster, "Conclusions: The Puritan World View and the Rise of Modern Science," in *The Great Instauration: Science, Medicine and Reform, 1626-1660* (London, Engl.: Gerland Duckworth & Co., 1975), 484-520.

October 14 Holiday.

8. October 16, 18, 21, 23, & 25 ***Early American Science and Technology.***
NOTE: MIDTERM EXAMINATION (open notes) on Oct. 21. Review on Oct. 18.
Reading:
Deetz, chapters 1, 4, and 5.
Pursell, chapters 2 and 3.

9. Oct. 28 & 30 November 1 ***Industrial Revolution.***
NOTE: Group 3 essays due at end of this unit.
Reading:
James Burke, "Credit Where It's Due," in *The Day the Universe Changed* (London, Engl.: British Broadcasting Corporation, 1985), 162-93.
Daniel R. Headrick, *The Tools of Empire: Technology and European Imperialism in the Nineteenth Century* (New York, N.Y.: Oxford Univ. Press, 1981), introduction and chapters 4, 9, and 15.
Pacey, chapters 7 and 8.
Recommended: Roy Porter, "Industrial Revolution & the Rise of the Science of Geology," in Mikulás Teich and Robert Young, eds., *Changing Perspectives in the History of Science: Essays in Honour of Joseph Needham* (London: Heinemann 1973), 320-43.

10. November 4, 6 & 8 ***American Science and Technology Transformed.***
Reading:
P. Thomas Carroll, "American Science Transformed," *American Scientist* 74 (September-October 1986): 466-85.
Robert V. Bruce, *The Launching of Modern American Science, 1846-1876* (Ithaca, N.Y.: Cornell Univ. Press, 1987), chapters 6, 11, and 24.
Pursell, chapters 5 and 7.

11. November 11,13,& 15 ***The Second Industrial Revolution.***
NOTE: Group 4 essays due at end of this unit.
Reading:
Pursell, chapters 11 and 12.
Hughes, chapters 1, 4, and 7.

12. November 18, 20,& 22 ***Scientific Age I: Conceptual Upheavals.***
Reading:
Paul Forman, "Weimar Culture, Causality, and Quantum Theory, 1918-1927: Adaptation by German Physicists and Mathematicians to a Hostile Intellectual Environment," *Historical Studies in the Physical Sciences* 3 (1971): 1-115.
Keller, begin reading preface and chapters 1, 3, 8, 9, 11, and 12.

November 25 and 27 Thanksgiving Holiday. Find out what your relatives believe about nature and study the messages in their artifacts.

13. December 2, 4 & 6 ***Scientific Age II: Big Science and Other Institutional Novelties.***
Reading:
Keller, finish reading assigned sections.
Derek J. de Solla Price, *Little Science, Big Science* (New York, N.Y.: Columbia Univ. Press, 1963), chapters 1 and 3.
Bernard Taper, "The Bittersweet Harvest," *Science80* 1, 7 (November 1980): 78-84.

14. December 9 and 11 Review for final exam.

COURSE SYLLABUS

DECISION MAKING

4130
Fall 1991

Linnda R. Caporael

Course Description:

For the last fifteen years, a revolution in the understanding of human judgment and choice has been dramatically challenging our ordinary beliefs about the human mind. This course is about that revolution and its consequences for understanding ourselves, other people, and the world around us. Our central interest is the comparison between descriptive decision making--how people do make decisions, and prescriptive decision making--how they should not make decisions. But we are also interested in different (albeit overlapping) approaches to the problem of judgment and choice. The broad question that puzzles us is, what is the relationship between prescriptive decision making and ordinary life?

The course objectives are to introduce you to the theoretical and empirical approaches to decision making, to introduce the terminology used in the field, and most importantly, to heighten your awareness of the fallibility of human judgment by considering common errors and appropriate corrective procedures. The course format will be largely "read and talk." It plays on the ideas in the earliest readings, those concerned with "mindfulness." How can we bring more mindfulness to classroom practice? There also will be occasional lectures, exercises, and demonstrations during class meetings. This course will be useful to (a) anyone who has to make decisions, and (b) anyone who believes people are "basically rational."

Required Texts:

Dawes, R.M. *Rational Choice in an Uncertain World* (Niles, Ill.: Harcourt Brace Jovanovich, 1988).

Langer, E.J. *Mindfulness* (Reading, Mass.: Addison-Wesley, 1989).

Grading:

15%	Final, Part I (6 pp.)	20%	Homework and pop quizzes (30 points)
20%	Test 1		
20%	Test 2	25%	Final, Part II (15 pp. min., 20 max.)

Course grades will be based on a modified curve. Every student in the class could obtain an A for the course. The highest overall grade will be used as an anchor. All grades within 10% of the highest one will be an A; grades in the second 10% interval will be a B, and so forth.

With the exception of tests and quizzes, you must hand in two copies of all your work. I will keep one and return the other one to you. All your papers must be typed and double-spaced; have 10 or 12 pitch font and about 25 lines of text to a page. You must keep one copy of your paper and hand in one copy to me (unless otherwise instructed). Occasionally, professors are exceedingly absent-minded and they can misplace a paper when they have to grade a lot of them.

First Things First–The Final:

The final is a formal, critical essay. In-text citations and complete references are required. These must be in "APA style," which is a variant of generic scientific bibliographic style. For examples see the article by Larrick, Morgan and Nisbett (1990). The story on the final is this: you get your essay question during the first week of school. Your answer is due the second week. I will grade it and give you feedback, and you have the rest of the semester to revise your answer. (Of course, by the end of the semester, you will have a lot more material on which to develop your essay.)

If your homework has been good and you received at least a C on Test 1 and you want to do a research paper instead, I am willing to talk about it.

Homework and Quizzes:

The "default" homework assignment is as follows: Write a class plan (as if you were the teacher/facilitator) that would help students/learners understand the main points of the readings and promote stimulating discussions. Indicate where you think students would have a problem with the readings (or where you think you are having difficulties) and explain what the problem is and why it is a problem (about two pages). The first homework assignment is due on Wednesday, Sept. 4. Subsequently, this assignment is due EVERY MONDAY except Oct. 7 and Dec. 15. You must turn it in by 10:00 a.m. to my mailbox in Sage 5508. Occasionally, I will give a substitute homework assignment. Occasionally, you (the class) will want to initiate an alternative homework assignment. You might even decide you want to eliminate the default homework. It is negotiable. The more responsibility you take for the class, the better.

Everyone starts out with 30 points, that is, with FULL CREDIT for this part of the grade. Homework and quizzes are given a minus (needs improvement), a check (good), a plus (very good) or "N/A" for feedback. "N/A" (not acceptable) means that I detected no sign of intelligent life in your homework. If you do not hand in your homework or if it is not acceptable, you lose 3 points.

Cheating:

There is no point in my talking about cheating because neither you nor I tolerate it.

CLASS SCHEDULE AND READINGS

Week No.	Date	Topic
A	Aug. 27	**Introduction** Assignment: Xerox all readings from Reserve Book Room

1	Sept. 4	**Automatic Thinking** Reading: Langer, Chapters 1-3 Dawes, Chapter 1 (Homework) Lave, J. *Cognition in Practice* (New York, N.Y.: Cambridge Univ. Press, 1988), pp. 1-18 and Chapter 8, pp. 170-90 Larrick, R.P., Morgan, J.N., and Nisbett, R.E., "Teaching the Use of Cost-Benefit Reasoning in Everyday Life," *Psychological Science* 1 (1990): 362-70 (A homework assignment is not required for this part of your readings--but you should be sure that you have read the material because this is what the Final, Part I covers.)
2	Sept. 9	**. . . And Its Costs.** Reading: Langer, Chapter 4 Dawes, Chapter 2 Neisser, Ulric, "Flashbulb Memories;" Loftus, E.F. and Palmer, J.C., "Reconstruction of Automobile Destruction;" Buckhout, R., "Eyewitness Testimony;" and Goethals, G.R., "Recalling Previously Held Attitudes" in Ulric Neisser, *Memory Observed* (San Francisco, Calif.: W.H. Freeman, 1982), pp. 23-48; 109-15; 116-25; and 178-88 Loftus, E. "Interrogating Eye Witnesses--Good Questions and Bad," in R. M. Hogarth, ed., *Question Framing and Response Consistency: New Directions for Methodology of Behavioral Science* (San Francisco, Calif.: Jossey-Bass, 1982), pp. 51-63
	Sept. 11	Final, Part I due
3	Sept. 16 Sept. 18	**Context and Categories.** Reading: Langer, Chapters 5-6 Schelling, T.C., "On the Ecology of Micromotives," *The Public Interest* 25 (1971): 59-98
4	Sept. 23 Sept. 25	**Framing Effects and Grouping Alternatives** Reading: Dawes, Chapters 3-4; Appendix A1
5	Sept. 30 Oct. 2	**The 3 Rs--Representativeness, Ratios, and Regression** Reading: Dawes, Chapter 5; Appendices A2 & A3 Shweder, R.A. "Likeness and Likelihood in Everyday Thought: Magical Thinking and Everyday Judgments about Personality," in P. N. Johnson-Laird and P.C. Wason, eds., *Thinking and Reasoning: Readings in Cognitive Science* (New York, N.Y.: Cambridge Univ. Press, 1977), pp. 446-67
6	Oct. 7 Oct. 9	**On Your Toes . . . Test Time** Reading: Dawes, Shweder, continued Test 1

7	Oct. 14 Oct. 16	No classes.
8	Oct. 21 Oct. 23	**Heuristics, Conjunctions, and Disjunctions** Reading: Dawes, Chapters 6-7
9	Oct. 28 Oct. 30	**Subjective Expected Utility Theory . . . and Tulip Bulbs** Reading: Dawes, Chapter 8 Malkiel, B. *A Random Walk Down Wall Street* (New York, N.Y.: Norton, 1985), pp. 28-45
10	Nov. 4 Nov. 6	**Dominating Strategies and Social Dilemmas** Reading: Dawes, Chapters 9-10 Hardin, G.R. "Tragedy of the Commons," *Science* 162 (1968): 1243-48 Langer, Chapter 9
11	Nov. 11 Nov. 13	**Letting Go as the Rational Thing to Do** Reading: Ross, L. and Anderson, C.A. "Shortcomings in the Attribution Process," in D. Kahneman, P. Slovic, and A. Tversky, eds., *Judgment under Uncertainty: Heuristics and Biases* (New York, N.Y.: Cambridge Univ. Press, 1982), pp. 129-52 Dawes, Chapters 11-12 Langer, Chapter 7
12	Nov. 18 Nov. 20	**Work and Health** Reading: Langer, Chapters 8, 10-Epilogue (scan earlier parts of the book)
13	Nov. 25	**Process or Outcome?** Test 2
	Nov. 27-29	Thanksgiving Break
14	Dec. 2 Dec. 4	**Cognition in Practice or Conflict with Rational Choice?** Reading: Lave, J. *Cognition in Practice* (New York, N.Y.: Cambridge Univ. Press, 1988), Chapters 5-6 Slovic, P., "Choice," in D. N. Osherson and E. E. Smith, eds., *Thinking: An Invitation to Cognitive Science*. Vol. 3. (Cambridge, Mass.: MIT Press, 1990), pp. 89-116 Cole, M., Hood, L., and McDermott, R. "Ecological Nitpicking," in U. Neisser, ed., *Memory Observed*, pp. 366-73
15	Dec. 4 Dec. 9 Dec. 11	**Of Cabbages, Kings, and Queens . . .** Penultimate version, Final, Part II Final, Part II

COURSE SYLLABUS

THE SOCIAL RELATIONS OF SCIENCE

4270 Sal Restivo

Introduction: All forms of knowledge and belief are products and reflections of social life. This course introduces and develops this idea for the case of science. The study of the social relations and social construction of science will be the focus of the course; this work, however, will be used to help us explore and illuminate the social nature of our ways of thinking and believing in general. Specific topics covered in this course include: the social construction of scientific facts in laboratories; scientists' discourse; replication and induction in scientific practice; the relationships between science and religion (and especially physics and mysticism); the sociology of mathematics; gender and science; and science and individual liberty.

Required Texts:

B. Latour and S. Woolgar, *Laboratory Life* (Beverly Hills, Calif.: Sage, 1979; reissued by Princeton, N.J.: Princeton Univ. Press, 1986).

G.N. Gilbert and M. Mulkay, *Opening Pandora's Box* (New York, N.Y.: Cambridge Univ. Press, 1984).

H.M. Collins, *Changing Order* (Beverly Hills, Calif.: Sage, 1985).

S. Restivo, *The Social Relations of Physics, Mysticism, and Mathematics* (Norwell, Mass.: D. Reidel, 1983).

Recommended Texts (also on library reserve):

M. Harrington, *The Politics of God's Funeral* (New York, N.Y.: Penguin, 1983).

G.E. Swanson, *The Birth of the Gods* (Ann Arbor, Mich.: Univ. of Michigan Press, 1974).

J. Randi, *The Faith Healers* (Buffalo, N.Y.: Prometheus Books, 1987).

On Library Reserve:

P. Feyerabend, *Science in a Free Society* (London, Engl.: NLB, 1978).

E. Keller, *Reflections on Gender and Science* (New Haven, Conn.: Yale Univ. Press, 1985).

F. Capra, *The Tao of Physics* (New York, N.Y.: Bantam, 1977).

R. Collins, "The Sociology of God," Chapter 2 in R. Collins, *Sociological Insight* (New York, N.Y.: Oxford Univ. Press, 1982).

M. Zenzen and S. Restivo, "The Mysterious Morphology of Immiscible Liquids," *Social Science Information* 21, no. 3 (1982): 447-73.

P.J. Bellomo, "Strategies for Ecological Reconstruction" (1987), unpublished manuscript.

D. Bloor, *Knowledge and Social Imagery* (New York, N.Y.: Routledge & Kegan Paul, 1976).

Course Requirements and Grading:

I expect you to attend, and participate actively in, each class.

I expect you to submit a brief paper each class period in which you report your reactions to and questions about the previous class discussion, lecture, project, and/or film; and your reactions to and questions about the assigned readings. Late reaction papers will not be accepted.

Your written responses should convey the fact that you have given some thought to the material. A short paragraph will be sufficient in most cases; one- or two-liners are not acceptable. This is the most important part of your work in this course; it is in writing these responses to class experiences that you will be exercising your creative and critical abilities. From my point of view, this course will be successful for you if it provokes you to think and gives you the opportunity to think. Your critical responses are also designed to help you prepare to contribute to class discussions. Any questions you have about material you encounter in this course should be noted in your critical responses. You should try to pose two or three questions for yourself and the class in response to each reading, film, lecture, and class discussion. I will begin most classes by calling on someone and asking him/her to read or paraphrase his/her critical responses to the prior class or the assigned reading.

Your reaction papers will be evaluated in terms of inclusiveness, organization, accuracy, clarity, use of "outside" or "personal" experiences when appropriate, and (this is the most important item) the extent to which you indicate that you have thought critically about the class materials. I will evaluate your reaction papers at midterm. If you receive an F, I will explain the reasons for the grade and you will be expected to make up the deficiencies by a certain date. Your reaction papers for the second half of the term will be evaluated at endterm.

There will be a series of approximately ten ethnography projects which will involve mini-studies of scientists and engineers "at work."

If you are interested in and have the appropriate background for getting more deeply involved in ethnography of science research, see me about the possibility of working on an on-going project I am involved in under a National Science Foundation grant.

Your final grade will be determined by averaging your grades on the midterm and endterm reaction papers and on the ethnography projects: 90-100 = A, 80-89 = B, 70-79 = C, and 60-69 = D.

Course Outline and Readings:

UNIT 1: GIVE ME A LABORATORY AND I WILL RAISE THE WORLD

Our anthropological observer is ...confronted with a strange tribe who spend the greatest part of their day coding, marking, altering, correcting, reading, and writing. ***Latour & Woolgar***

1. Orientation.
2. What is science, and what is so great about it?

There are two questions that arise in the course of any discussion of science. They are: (A) WHAT IS SCIENCE? - how does it proceed, what are its results, how do its standards, procedures, results differ from the standards, procedures, results of other fields? (B) WHAT IS SO GREAT ABOUT SCIENCE? - what makes science preferable to other forms of existence, using different standards and getting different results as a consequence? What makes modern science preferable to the science of the Aristotelians, or to the cosmology of the Hopi? ...Question A has not one answer but many .... There exists hardly anyone who asks question B. The excellence is ASSUMED, it is not ARGUED FOR. ***Paul Feyerabend***

Video: "Eduardo the Healer"

Readings:
Latour and Woolgar, *Laboratory Life.*
M. Zenzen and S. Restivo, "The Mysterious Morphology of Immiscible Liquids" (on reserve).

UNIT II: JUST THE FACTS

The physicist Leo Szilard once announced to his friend Hans Bethe that he was thinking of keeping a diary: 'I don't intend to publish it; I am merely going to record the facts for the information of God.' 'Don't you think God knows the facts?' Bethe asked. 'Yes,' said Szilard. 'He knows the facts, but he does not know this version of the facts.' ***Freeman Dyson***

We will try to show that, analytically, there is much to be gained by opening Pandora's Box in the sense of setting free the multitude of divergent and conflicting voices with which scientists speak. ***Gilbert and Mulkay***

Reading:
Gilbert and Mulkay, *Opening Pandora's Box.*

UNIT III: HOW SHIPS GET INTO BOTTLES AND OUT AGAIN

The ships are bits of knowledge and the bottles are truth. Knowledge is like a ship because once it is in the bottle of truth it looks as though it must always have been there and it looks as though it could never get out again. Since order and knowledge are but two sides of the same coin, changing knowledge is changing order. ***H. Collins***

Reading:
Collins, *Changing Order.*

UNIT IV: THE LOGIC OF THE POISONED CHICKEN, AND OTHER TALES OF TRUTH

...classification is a process of invention rather than discovery...our classifications of the natural world are 'made' rather than 'found'. If this is the case, then in an important, indeed fundamental sense, classifications of the natural world have the status of CONVENTIONS and are thus sustained and modified in response to changing patterns of social contingencies. ***John Dean***

If thought is so much out in the world as this, what is to guarantee its generality, its objectivity, its efficacy, or its truth? ***Clifford Geertz***

Reading: Bloor, *Knowledge and Social Imagery* (on reserve).

UNIT V: DOES SCIENCE HAVE A GENDER?

In sympathy with, and even in response to, the growing division between male and female, public and private, work and home, modern science opted for an ever greater polarization of mind and nature, reason and feeling, objective and subjective.... ***Evelyn Keller***

Reading:
Keller, "Gender and Science," Chapter 4 in *Reflections on Gender and Science* (on reserve).

UNIT VI: IS SCIENCE A THREAT TO DEMOCRACY?

Must we not demand that ideas and procedures that give substance to the lives of people be made full members of a free society no matter what other traditions think about them? ***Paul Feyerabend***

Reading:
P. Feyerabend, "Science in a Free Society," Part II in *Science in a Free Society* (on reserve).

UNIT VII: IS PHYSICS WU LI, AND WHO CARES?

Wu Li = Patterns of Organic Energy
My way
Nonsense
I Clutch my Ideas
Enlightenment

I was sitting by the ocean one late summer afternoon, watching the waves rolling in and feeling the rhythm of my breathing, when I suddenly became aware of my whole environment as being engaged in a gigantic cosmic dance....I 'saw' the atoms of the elements and those of my body participating in this cosmic dance of energy; I felt its rhythm and I 'heard' its sound, and at that moment I knew that this was the Dance of Shiva, the Lord of Dancers.... Physicist ***F. Capra***

Bread and meat would have robbed the ecstatic of many an angel visit: the opening of the refectory door must many a time have closed the gates of heaven to his gaze. Anthropologist ***E.B. Tylor***

Readings:
H. Rolston, *Science and Religion*, pp. 34-65 (on reserve).
F. Capra, "The New Physics," Chapter 4 in *The Tao of Physics* (on reserve).
F. Capra, "The Way of Eastern Mysticism," Part II in *The Tao of Physics* (on reserve).
F. Capra, "Interpenetration," Chapter 18 in *The Tao of Physics* (on reserve).
R. Collins, "The Sociology of God," Chapter 2 in *Sociological Insight* (on reserve).
S. Restivo, "Mysticism as a Social Fact," and "Physics as a Social Fact," Chapters 3-4 in *The Social Relations of Physics, Mysticism, and Mathematics*.

UNIT VIII: GOD, THE PHYSICISTS, AND BEYOND

Physicists, according to Capra, 'have made a leap towards the world view of the Eastern mystics' ....Even if Capra is, in some sense, correct, it is not intuitively obvious nor logically necessary that the next step (or steps) must be in this same direction. We must also entertain the possibility that the 'great step' was, from the point of view of the future of physics, a step in the wrong direction. ***S. Restivo***

Culture is developed and evaluated in particular historical situations. It cannot be studied apart from its use; its use is how we know it. Differentiated kinds of culture, such as we perceive 'science' or 'ideology' to be, are not concrete embodiments of different kinds of interest; rather they are single sets of resources more or less commonly used and evaluated in particular kinds of context with regard to particular kinds of interest. ***S. Shapin***

...the rationality of our society depends on its social structure. We witness in recent centuries a great progress called 'secularization,' which 'disenchants' the world of superstitious ideas, substitutes scientific explanation, displaces religious authority, and substitutes legal-rational institutions...Precisely because society is integrated by the reciprocal dependencies of the division of labor, it does not require fanatical adherence to religious beliefs to hold together; therefore rational ideas can prevail. If the Valkyries are not to return, therefore, we must hope to see a healthful continuance of organic integration. But what in fact happens to organic solidarity in our time?* ***Daniel O'Keefe***

* Valkyries - maidens of Odin who choose the heroes to be slain in battle and conduct them to Valhalla (the Hall of Odin).

Reading:

S. Restivo, "The Physicist and the Sufi Master," "Interests and Ideas," and "Parallelism, Science, and Society," pp. 15-21, Chapter 5 and Chapter 6, in *The Social Relations of Physics, Mysticism, and Mathematics*.

UNIT IX: THE (POLITICAL) SCIENTIST AT GOD'S FUNERAL

Religiosity....is indeed surviving the decline of religion. But religiosity does not provide the norms to integrate a society, much less a civilization. Therefore the present crisis demands something unprecedented: a united front of believers and atheists in search of a common transcendental which is neither supernatural nor anti-supernatural. ***M. Harrington***

Reading:

Selections from Harrington, Swanson, and Randi (on reserve).

UNIT X: 2+2=4, 2+2=5, AND OTHER MATHEMATICAL TRUTHS

...the emphasis on controlling the labor process in the seventeenth century corresponded to a mathematics of process [calculus]; earlier, the merchants' requirements in calculating commodity transactions had been met by the development of algebra. ***S. Restivo***

Reading:

S. Restivo, "Mathematics in Ancient Greece," and "Mathematics in Europe, 1200-1700," Chapters 14 and 15 in *The Social Relations of Physics, Mysticism, and Mathematics*.

UNIT XI: ANARCHY AND INQUIRY

What I preach then is, to a certain extent, the revolt of life against science, or rather against the government of science, not to destroy science--that would be high treason to humanity--but to remand it to its place so that it can never leave it again. ***Michael Bakunin***

Reading:

P. Bellomo, "Strategies for Ecological Reconstruction" (on reserve).

S. Restivo, "Epistemic Strategies, Society, and Social Change," Chapter 7 in *The Social Relations of Physics, Mysticism, and Mathematics*.

Video: "Worlds Without End"

UNIT XII: STUDENT VOICES

Each of us has now a chance to combine his/her own self-liberation with objective social change and thereby, with the liberation of others. ***Restivo/Feyerabend***

COURSE SYLLABUS

RISKY TECHNOLOGIES

4400 Ned Woodhouse

Course Description: This course analyzes decision making about risky technologies, especially those posing threats to human health and to the environment. Primary attention will be given to nuclear power, fossil fuel combustion, and problems posed by chemicals (such as acid rain, ozone depletion, and hazardous wastes). We also will analyze automobile safety, medical technologies, and various intangible risks such as ugliness. Additional topics may be chosen by the class.

The overall questions we will be addressing are: How do technological societies diagnose and reduce risks from civilian technology? How well is the system working? How could it be improved? To answer these questions requires some understanding of the technical aspects of the various risks, but our main focus will be on the social dimensions:

Political--Congress, the Environmental Protection Agency, presidential decision making, scientific advisory mechanisms, courts;

Social/psychological--public opinion, biases in humans' judgments about risks;

Economics--how much money should be devoted to reducing a given risk, the influence of the corporate sector on decisions about risk.

The course obviously will give you considerable information about technological risks. But its longer lasting purpose is to help you think more clearly and deeply about decision making. Risky technologies have a potential for glamorous catastrophes, so they get a lot of attention. But many decisions in business, government, and personal life have to be made under conditions similar to those we will be studying: high uncertainty and potentially severe consequences of error. If you come to understand how good decisions ought to be made under such conditions, you may be able to apply the lessons in other life arenas.

Course Requirements: The class is conducted as an advanced seminar, not as a lecture course; so reading, writing, and group discussion are the primary activities. For this method to succeed, at least three ingredients are required:

1. Do the reading before the class at which it is to be discussed, faithfully and carefully;
2. Come to class regularly, and participate actively (but not excessively) in discussions;
3. Gradually develop your own agenda of what you are trying to figure out about risky technologies, so you can pose puzzles for the rest of us.

There will be no exams. Part of the written work will be a research paper of approximately fifteen pages on a topic of your choice (approved by me). The project will proceed in five stages: agreement on the raw idea, then a bibliography, two-page outline, rough draft, and final draft. I will help you every step of the way. Further details later.

Second, the entire class will collaborate on a group project. The precise topic and procedures will be defined by you. The general goal is to present a plan for substantially improving the human benefits derived from technologies, while substantially reducing the health, environmental, and other risks/costs induced by the use of technologies. Some of the work on this will be done in class each week.

There will be various other small assignments, generally connected with your thoughts about the readings. If you need a light work load, or are not able to attend and participate regularly, you should find a more appropriate course. More concretely: since there are a total of just fourteen class meetings, only one absence is permitted during the semester.

Grading: Roughly equal weight will be given to class participation, the overall group of small assignments, the individual research paper, and the class project. Depending on how the class project works out, it may be weighted less. There is no curve, so everyone can potentially earn an A. This is not likely, but I would be delighted if it worked out that way.

Readings:

Morone, Joseph G., and Edward J. Woodhouse, *Averting Catastrophe: Strategies for Regulating Risky Technologies* (Berkeley: Univ. of California Press, 1986).

Perrow, Charles, *Normal Accidents: Living with High-Risk Technologies* (New York, N.Y.: Basic Books, 1984).

Morone, Joseph G., and Edward J. Woodhouse, *The Demise of Nuclear Energy? Lessons for Democratic Control of Technology* (New Haven, Conn.: Yale Univ. Press, 1989).

Regens, James L., and Robert W. Rycroft, *The Acid Rain Controversy* (Pittsburgh, Pa.: Univ. of Pittsburgh Press, 1988).

Stross, Randall E., *Technology and Society in Twentieth Century America: An Anthology* (Chicago, Ill.: Dorsey Press, 1989).

Walker, Charles A., et al., eds., *Too Hot to Handle? Social and Policy Issues in the Management of Radioactive Wastes* (New Haven, Conn.: Yale Univ. Press, 1983).

Additional readings will be on reserve in the library.

PROBLEM SETS: Typing required. Suggested length about 6 pages. Depth is the real issue though, not length *per se*. My reactions to your first problem set should help you gauge whether you need to do more, or can get by with less. The main point of the problem sets is to help stimulate and focus your thinking. A second purpose is to show me that you are doing the reading, and grasping the key points. So when you get finished with a problem set, reread what you have done. If it will not be obvious to me that you have accomplished both the above tasks, write something additional at the end of your problem set to correct the omission.

SET #1:

1. Which civilian technological activities pose the greatest risks to the environment and/or to human health in your judgment? (I know you don't have much information at present, do not worry about it: this is just to get you started thinking about the subject.)

Among other activities, you may want to think about nuclear power plants, chemical manufacturing plants, transportation of hazardous substances, space exploration (non-military aspects), building construction, industrial accidents, alcohol, tobacco, pesticides, depletion of the ozone layer, warming of the earth's atmosphere (greenhouse effect), automobile accidents, erosion, dams, medical procedures and pharmaceuticals, and whatever else you want to include. I recommend making a chart that ranks various risks according to the number of people potentially affected, number of people actually affected last year, magnitude of the potential risk, magnitude of the actual damage caused to date, or whatever other categories you want to use.

2. On balance, for which of the above technologies do the benefits justify the risks? Which are not justified, if any? What standard are you using to decide?

3. How do you <u>feel</u> about civilian technological risks (e.g., secure, or scared, or anxious, or unconcerned, or....)?

SET #2:

<u>Reading</u>: Morone and Woodhouse, *Averting Catastrophe*.

Please answer the following questions in a total of about 5-6 typed pages.

1. What questions do the authors say they are trying to answer? Do you think they succeed in providing persuasive answers? Why or why not?
2. Pick any one of the cases covered in *Averting Catastrophe* (except Recombinant DNA) and describe how you would like to see the risk handled differently than we now are.

3. Explain sophisticated trial-and-error (=catastrophe-aversion system). Would it be a good idea to apply sophisticated trial-and-error to other types of technological decisions, such as changes in production processes (robotics) or the sale of new items (computers)? What about risky personal decisions, like marriage/divorce?

4. Your reaction to the book: What shortcomings did you find in it (e.g., other stuff you wish had been included, factual errors, political biases, whatever)? How have the views you expressed in Problem Set #1 been modified and/or enriched by the case studies and concepts in *Averting Catastrophe*?

SET #3:

Reading: Perrow, *Normal Accidents*.

1. (a) What are the main points of Chapter 3, "Complexity, Coupling and Catastrophe"?
   (b) Boil it all down to two or three sentences.

2. How do the risks posed by petrochemical plants and air travel differ? How are they similar?

3. What does Perrow mean by the term "error-inducing system"? Do you think it is applicable to risky technologies other than marine transport?

4. What new points are added by Chapters 7 ("Earthbound Systems") and 8 ("Exotics")? What is not new, but helps reinforce ideas introduced in earlier chapters?

5. Do you agree with Perrow's overall conclusions in chapter 9? Why or why not?

6. Overall, how has this book helped you to improve your thinking about risky technologies?

SET #4:

Reading: Woodhouse and Morone, *The Demise of American Nuclear Energy?*; Christopher Flavin, *Reassessing Nuclear Power: The Fallout from Chernobyl*, Worldwatch Paper #75 (Washington, D.C.: Worldwatch Institute, 1987; and Nealey and Hebert, "Public Attitudes About Radioactive Wastes," Slovic and Fischhoff, "How Safe is Safe Enough?", and Walker, et al., "Value Issues in Radioactive Waste Management," in Walker, et al., eds., *Too Hot to Handle*?

1. Briefly outline the argument offered in *Demise*.

2. How does the analysis of nuclear power in *Demise* compare with the arguments given in Perrow's *Normal Accidents* and in the "Chernobyl" reading? What are the strengths and weaknesses of each?

3. Summarize the main points of Nealey/Hebert and Slovic/Fischhoff concerning how the public thinks about risk. On reflection, does their view seem to reflect what you see the public doing?

4. How have your opinions about nuclear power been confirmed or modified as a result of the readings you have done for the course?

5. Looking back on the nuclear power experience, what do you think society should learn from it in order to improve decision making about future technologies?

6. Considering the course as a whole, what were the most important concepts or information that you got out of it? Would any of it be helpful to you in making sense of the next new risk that comes along? Would any of it be worth remembering in 5 to 10 years, or is it knowledge of a more temporary sort? Do you have any suggestions for improving the course?

OPEN FORUM

NEW JOURNALS

Science & Education: Contributions From History, Philosophy and Sociology of Science and Mathematics

Kluwer Academic Publishers have commenced a new journal titled: *Science & Education: Contributions From History, Philosophy and Sociology of Science and Mathematics*. It will be published quarterly beginning January 1992, and is affiliated with the International History, Philosophy, and Science Technology Group. The editor is Michael R. Mathew, School of Education, University of New South Wales, Kensington, NSW2033, Australia. *Science & Education* will be a cross-disciplinary forum. The members of the editorial committee are drawn from philosophers of science, philosophers of education, historians of science, cognitive psychologists, scientists and mathematicians, science and mathematics teachers, and educators and represent fourteen countries.

One major division that *Science & Education* seeks to overcome is that between researchers in mathematics education and researchers in science education. Seldom, particularly in the Anglo world, do these two groups meet or read each others work: conferences, journals, and books are usually directed to one or the other of the groups, but not to both. The history and philosophy of science and mathematics are interwoven disciplines, they are a natural vehicle for bringing the two communities together. *Science & Education* hopes to contribute to the improvement of science and mathematics teacher education programs by publishing accounts of successful courses which have included history, philosophy and sociology, and by other means. Straight historical, philosophical and sociological studies will be published, but only if they bear upon recognizable pedagogical concerns and subject matter. One major development of the past 25 years in science education has been the introduction of Science-Technology-Society (STS) courses. Most of these raise questions about the history, philosophy and sociology of science. *Science & Education* will also provide a forum in which these topics can be explored.

Subscription: US $20.00 per year for members of the International History, Philosophy and Science Teaching Group. (Membership is US $15.00 per year; checks or charge card details to the editor). Other individuals US $69.00 per year--institutional subscriptions US $122, plus $15.50 mailing.

Contributions: Papers, reports, and letters are welcome. Clear and lucid writing which is intelligible across a number of disciplines is encouraged. The standard Kluwer format for presentation and referencing as found in journals such as *Synthese, Biology & Philosophy*, and *Educational Studies in Mathematics* is to be used. Full style guidelines are available from Kluwer. Three copies of a double-spaced manuscript are required and submission on IBM compatible disc is encouraged. Send to The Editor, *Science & Education*, c/o Kluwer Academic Publishers, P. O. Box 322, 3300 AH Dordrecht, The Netherlands.

ENVIRONMENTAL VALUES

Environmental Values is a new international journal concerned with the rational basis and justification of environmental policy. It aims to bring together contributions from philosophy, law, economics and other disciplines, which relates to the present and future environment of humans and other species, and to clarify the relationship between practical policy issues and more fundamental underlying principles or assumptions. A major aim of *Environmental Values* is to provide a forum for original academic papers which are accessible to people from other disciplines, and therefore also to those who operate outside the academic community. Although the scope of the journal will be restricted to relatively non-technical papers, this does not imply any sacrifice of standards. All papers will be refereed by experts in the relevant fields, and it is hoped that the prospect of a broader and more influential readership than that reached by many more specialist journals will attract authors of a high calibre. It is also proposed to publish regular review articles of recent work.

Authors should submit 2 copies of their papers to Alan Holland, Editor, Department of Philosophy, Lancaster University, Lancaster LA1 4YT, U.K. Fax 0524 843085. Full instructions for authors are available from the editor, or from Andrew Johnson, The White Horse Press, 10 High Street, Knapwell, Cambridge, CB3 8NR, U.K. Subscription: Special offer before January 1, 1992 - Individual: $35 US, £ 20; Institutional: $70 US, £ 40. After January 1, 1992: Individual: $60 US, £32; Institutional: $110 US; £ 64. The White Horse Press, 1 Strond, Isle of Harris, Scotland, PA 83 3UD.

CALL FOR PAPERS

THE VII BIENNIAL CONGRESS OF THE SOCIETY FOR PHILOSOPHY AND TECHNOLOGY

May 21-23, 1993
Valencia, Spain

The general topic of the Congress is *Technology and Ecology*, but papers on other topics relevant to philosophy and technology, broadly conceived, are also welcome. Papers may be submitted in either English or Spanish. Conference papers should include a 100 word abstract, and may be submitted in three categories: Symposium Papers: presentation time 30 minutes (4000 words); Working Papers: presentation time 15 minutes (2000 words); and Poster Sessions.

The deadline for submissions is September 1, 1992. Send submissions to: Larry Hickman, Department of Philosophy, Texas A&M University, College Station, Texas 77843-4237.

WORLD TURNING CONFERENCE

April 21-25, 1993
Hagley Museum and Library, Wilmington, Delaware

The Hagley Museum and Library and the Wood Turning Center of Philadelphia, Pennsylvania, are co-sponsoring an international *World Turning Conference* that explores the social, technical and aesthetic context of lathe work, drawing from specialists in furniture history, the history of technology, and contemporary crafts. Lecture, Panel, Demonstration and Workshop Proposals: Variable topics, half hour to two hour periods.

Application Process: Interested contributors must submit a complete application by August 1, 1992. For applications, please contact Albert LeCoff at the Wood Turning Center, PO Box 25706, Philadelphia, Pennsylvania 19144; phone [215] 844-2188 or FAX [215] 844-6116. The Hagley Museum and Library and the Wood Turning Center will seek funding to support travel and/or lodging expenses but participants should also seek funding from their own institutions.

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CALL FOR SCIENTIFIC QUOTATIONS

The *Oxford Dictionary of Scientific Quotations* seeks interesting and appropriate quotations from scientists (living or dead) and from writers upon science. Anyone interested in submitting quotations that are instructive, amusing, characteristic of a certain individual, crucial in formulating scientific principles, etc., with fullest possible original source references, should contact the Editors, *ODSQ*, Wellcome Institute for the History of Medicine, 183 Euston Road, London NW1 2BN, England.

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TRINITY COLLEGE
DANA PROFESSORSHIP

Supported by funds from the Charles A. Dana Foundation, Trinity College is seeking a senior faculty member interested in a visiting appointment to begin in the fall of 1992 or 1993. The Dana Professorship is designed to bring to the College a person whose field of expertise lies outside that of other members of the faculty. The fields in which we are currently interested are: (1) Anthropology (exclusive of European cultures); (2) Linguistics; and (3) Science, technology and society. Candidates should have records of distinguished teaching and scholarship; they should bring a special commitment to involving undergraduate students in the excitement of intellectual life while bridging disciplinary boundaries. The term of the appointment is 1 to 3 years and may be renewable. Salary and benefits are competitive.

Send letter, curriculum vitae, and names of three references to: Prof. David Robbins, Dept. of Mathematics, Trinity College, Hartford, CT 06106. Women and minority groups are especially welcome to apply. The search committee will begin reading applications in January 1992. Trinity College is an EOAA employer.

Forthcoming Meetings and Conferences

April 2-6, 1992. *Inventing the Future: New Technology, Perception and Meaning*, Baltimore, Md. An exploration of technology's influences on the way we write, design, and publish. Contact: The Institute for Publications Design, Yale Gordon College of Liberal Arts, Univ. of Baltimore, 1420 N. Charles St., Baltimore, MD 21201-5779; [410] 234-3920 or [401] 625-3294/5.

April 3-5, 1992. *Conference on Earth Rights and Responsibilities: The Confluence of Human Rights and Environmental Protection*, Yale University. Contact: Liz Barratt-Brown or David Christensen, National Resource Defense Council, 1350 New York Ave., N.W., Suite 300, Washington, D.C. 20005-4705; [202] 783-7800.

April 4-5, 1992. *Culture and Ethnicity of Industrialization*, Third Annual Woonsocket, Rhode Island National History Conference. Contact: Doug Reynolds, Blackstone River Valley National Heritage Corridor Commission, P.O. Box 34, Uxbridge, MA 01569; [508] 278-9400; or Scott Molloy, Labor Research Center, University of Rhode Island, Adams House, 85 Upper College Road, Kingston, R.I. 02881; [401] 792-2239.

April 5-7, 1992. *Theory Meets Practice*, Second International Conference on Ethics and Environmental Policies, Athens, Georgia. Contact: Peter G. Hartel, Symposium Coordinator, Dept. of Agronomy, 3111 Plant Sciences, Univ. of Georgia, Athens, GA. 30602; Phone: [404] 542-0898; Fax: [401] 542-0914.

May 2-3, 1992. *DIAC-92--Directions and Implications of Advanced Computing,* Berkeley, Calif. 4th DIAC Symposium sponsored by the Computer Professionals for Social Responsibility. Contact: Program Chair: Douglas Schuler, 2202 N. 41st St., Seattle, WA 98103; [206] 632-1659 (home); [206] 865-3832 (work), Email: dschuler@june.cs.washington.edu.

May 11-15, 1992. *History and Philosophy of Science in Science Teaching*, Second International Conference, Queen's University, Kingston, Ontario, Canada. Contact: Skip Hills, Conference Secretary, Faculty of Education, Queen's University, Kingston, Ont. K7L 3N6; Phone: [613] 545-6208; FAX: [613] 545-6584; Email: Hills@QUCDN.

June 14-20, 1992. *Visions for a Sustainable World*. Seventh Biennial Student Pugwash USA International Conference, Emory University, Atlanta, Georgia. Application Deadline: February 15, 1992. Contact: Timothy Larson, Student Pugwash USA, 1638 R Street, N.W., Suite 32, Washington, D.C. 20009; [202] 328-6555.

June 28-July 1, 1992. *National Forum on Water Management Policy*, Washington, D.C. Sponsored by American Water Resources Assoc. Contact: Michael C. Fink, Dir. of Meetings, AWRA, 5410 Grosvenor Lane, Suite 220, Bethesda, MD 20814-2192; [301] 493-8600; Fax: [301] 493-5844.

August 12-15, 1992. *4S/EASST,* Gothenburg, Sweden. The Society for Social Studies of Science annual meeting will be held jointly with the European Association for the Study of Science and Technology. Contact: John Hultburg, Center for Science Studies, Univ. of Gothenburg, S-41298 Gothenburg, Sweden. Phone: 46-31-631929; Fax: 46-31-634723.

August 16-21, 1992. *Society for the History of Technology*, Annual Meeting, Uppsala University, Sweden. Contact: Håkon With Andersen, Center for Technology and Society, Univ. of Trondheim at Lade, N-7055 Dragvoll, Norway. Phone: 47-7-591789; Fax: 47-7-591327; Bitnet: H_Andersen@ AVH.UNIT.UNINETT. For conference information contact: Uppsala Turist & Kongress, "SHOT," Box 216, S-751 04 Uppsala, Sweden. Fax: 46-18-132895.

October 9-10, 1992. *Interface '92*, Sixteenth Annual Humanities and Technology Conference, Marietta (metro Atlanta), Georgia. Proposal abstracts due by May 1, 1992. Contact: Mark Stevens or Pamela McMahon, Dept. of Humanities and Social Sciences, Southern College of Technology, 1100 S. Marietta Parkway, Marietta, GA. 30060-2896; [404] 528-7202.

October 8-11, 1992. *Society for Literature and Science*, Atlanta, Georgia. Proposal abstracts due by Feb. 1, 1992. Contact: Pamela Gossin, History of Science Dept., 601 Elm, Room 622, Univ. of Oklahoma, Norman, Okla. 73019.

January 3-8, 1993. *Science Education in Developing Countries: From Theory to Practice.* Jerusalem, Israel. Contact: Avi Hofstein, Dept. of Science Teaching, The Weizmann Institute of Science, Rehovot 76100, Israel; Phone: 972-8-342278; Fax: 972-8-344115; Email: NTHOFSTN@WEIZMANN.

BROWN, LESTER R., ET AL. *STATE OF THE WORLD-1992*. WASHINGTON, D.C.: WORLDWATCH INSTITUTE, 1992. 256 P. PAPERBACK: $10.95.

Twenty years ago the 1972 Stockholm Conference on the Human Environment helped to inspire the international environmental movement; this June "Earth Summit," the U.N. Conference on Environment and Development, will be held in Rio de Janeiro in the hopes of similarly inspiring the move toward shaping an environmentally sustainable global economy. This year's *State of the World* report from the Worldwatch Institute is dedicated to the success of that conference and movement. Contents include: Sandra Postel, "Denial in the Decisive Decade;" John C. Ryan, "Conserving Biological Diversity;" Christopher Flavin, "Building a Bridge to Sustainable Energy;" Nicholas Lenssen, "Confronting Nuclear Waste;" Alan Thein Durning and Holly B. Brough, "Reforming the Livestock Economy;" Jodi L. Jacobson, "Improving Women's Reproductive Health;" John E. Young, "Mining the Earth;" Marcia D. Lowe, "Shaping Cities;" Michael Renner, "Creating Sustainable Jobs in Industrial Countries;" Hilary F. French, "Strengthening Global Environmental Governance;" and Lester R. Brown, "Launching the Environmental Revolution."

HOPPER, DAVID H. *TECHNOLOGY, THEOLOGY AND THE IDEA OF PROGRESS*. LOUISVILLE, KY.: WESTMINSTER/JOHN KNOX PRESS, 1991. 153 P. PAPERBACK: $14.95.

Hopper examines modern technology in the context of the idea of progress and theology. Drawing on recent events such as the technological disasters of Chernobyl and *Challenger*, he questions the frequent equation of technology and progress. He suggests the "addictive" nature of technology--"its capacity to afford immense satisfaction and stimulation; its capacity to command human acquiescence and commitment; its ability to provide an ongoing but limited sense of purpose and meaning for life"--has been responsible for disillusion with democratic political progress and the subsequent elevation of the technological in late 20th-century life. Although Hopper rejects a simplistic religious culpability for technological problems, especially vis-à-vis environmental concerns such as that posited by Lynn White, jr., he does not see the theological response as adequate either. Thus, somewhat like Jacques Ellul, he calls for a "critical distancing" in the public's understanding of and a correspondingly increased involvement with the technological events of our time if we are to regain a Christian "purpose of community building" and "preserving life itself." This volume would be a useful ancillary text in a variety of STS courses, and perhaps especially those taught from a values or religion studies perspective.

SHRADER-FRECHETTE, K. S. *RISK AND RATIONALITY: PHILOSOPHICAL FOUNDATIONS FOR POPULIST REFORMS*. BERKELEY: UNIV. OF CALIFORNIA PRESS, 1991. X, 312 P. PAPERBACK: $15.95.

Large segments of the public clearly have an aversion to environmental and societal risks associated with modern technology and industry. Is this aversion a form of mass paranoia based on an ignorance of science and technology, or is it a response to the oppression of "big industry," "big technology," and "big government"? "Not surprisingly," Shrader-Frechette argues, "the correct answer lies between these two extremes." In this volume the author sketches out a middle path, arguing for a new approach to evaluating contemporary, "societally imposed" risks, in contrast to those that are personally chosen such as diet drinks. Shrader-Frechette argues for a new paradigm of "scientific proceduralism." "According to this paradigm, risk evaluation is 'procedural' in that it ought to be guided by democratic processes and ethical principles," and scientific, or objective, "because it is based in part on 'probabilities,' and because it is assessed on the basis of its 'explanatory and predictive power....'" Furthermore, she argues, "risk evaluation ought to be defined in terms of social and ethical values" (p. 12).

Ultimately, Shrader-Frechette posits that "science need not co-opt democracy" (p. 13). Although written primarily for a scholarly audience, this volume could be fruitfully used in advanced STS courses, in such areas as risk assessment and public policy.

SLADOVICH, HEDY E., ED., *ENGINEERING AS A SOCIAL ENTERPRISE*. WASHINGTON, D.C.: NATIONAL ACADEMY PRESS, 1991. 113 P. PAPERBACK: $19.00.

"Engineering is not often thought of as a social enterprise. But in fact social needs and pressures shape what engineers do as much as engineering and technology shape the nature of society" (p. v.). So opens the Preface to this volume of essays based on a 1990 National Academy of Engineering symposium dedicated to NAE founding member J. Herbert Holloman and marking the close of the 25th anniversary year celebration of the Academy. The six major essays include examinations of the societal forces shaping engineering and in turn the influences engineering has on society historically, contemporaneously, and for the future. Contents include: Walter G. Vincenti, "Introduction;" Thomas P. Hughes, "From Deterministic Dynamos to Seamless-Web Systems;" Robert McC. Adams, "Cultural and Sociotechnical Values;" Marina v.N. Whitman, "Business, Consumers, and Society-at-Large: New Demands and Expectations;" John W. Fairclough, "Technology and Government;" George Bugliarello, "The Social Function to Engineering: A Current Assessment;" and Robert W. Lucky, "Pondering the Unpredictability of the Sociotechnical System." Also included is Holloman's presentation on "Engineering's Great Challenge--The 1960s," originally delivered in February 1960 at a joint meeting of regional engineering groups commemorating National Engineers Week, in which he proposed the creation of a National Academy of Engineering.

WAJCMAN, JUDY. *FEMINISM CONFRONTS TECHNOLOGY*. UNIVERSITY PARK: PENNSYLVANIA STATE UNIV. PRESS, 1991. 184 P. ILLUS., BIBLIOG. HARDCOVER: $28.50; PAPERBACK: $13.95.

Wajcman analyzes the connections between technology and gender, especially as related to such areas as labor, reproductive technology, household technology, and the built environment. It is the author's contention that technology in Western industrial culture has been shaped by the dominant "ideology of masculinity." However, recognition of this "profoundly gendered character of technology need not lead to political pessimism or total rejection of existing technologies," rather such realization "opens up fresh possibilities for feminist scholarship and action." Wajcman concludes with a call for rejecting the notion of technology as a neutral force. Such a recognition is a necessary precursor to any transformation of technology based on a transformation of gender relations. Broad ranging and accessible by scholars and students alike, this volume would be an excellent text in a wide variety of STS courses.

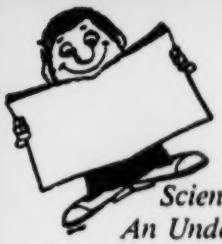
OTHER WORKS RECEIVED

O'HARA, SUSAN PRITCHARD AND GREGORY GRAVES. *SAVING CALIFORNIA'S COAST: ARMY ENGINEERS AT OCEANSIDE AND HUMBOLDT BAY*. WESTERN LANDS AND WATER SERIES, 16. SPOKANE, WASH.: ARTHUR H. CLARK, 1991. 277 P. ILLUS., MAPS, BIBLIOG. HARDCOVER: $38.50.

Oceanside Harbor and Humboldt Bay are two examples of the U.S. Corps of Engineers' ongoing struggles to deal with California coastal engineering problems since 1853. This dual study details Corps efforts in these two harbor-related engineering projects. A good example of Corps supported historical research.

SCHWARTZMAN, SIMON. *A SPACE FOR SCIENCE: THE DEVELOPMENT OF THE SCIENTIFIC COMMUNITY IN BRAZIL*. UNIVERSITY PARK: PENNSYLVANIA STATE UNIV. PRESS, 1992. 286 P. BIBLIOG. HARDCOVER: $32.50.

An extensively updated and expanded version of a study originally published in Portuguese in 1979 and now out of print, this volume details the historical development of the natural sciences in Brazil and analyzes their current predicament. Schwartzman emphasizes the social, cultural, and institutional contexts of Brazilian science and discusses the importance to Brazil of foreign-trained scientists and foreign models of research and higher education.



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Science, Technology & Society is a newsletter devoted to the general area of science, technology, and society studies. It is a joint project of the Lehigh University STS Program and the Technology Studies Resource Center and publishes short articles on the theoretical and speculative aspects of curriculum development, in-depth program and course descriptions, reviews of texts and audio-visual aids, and an annotated bibliography of current books and articles. An "Open Forum" section exists for readers with questions, comments or announcements regarding STS activities or needs. Our goal is to help generate new courses, and provide an information exchange, in the STS field. Subscriptions, covering six issues, are available for $8.00 per year--checks payable to Lehigh University. Back issues are available for $1.50 each.

Please address all materials for publication and correspondence to: Dr. Stephen H. Cutcliffe, Editor, STS Newsletter, 327 Maginnes Hall #9, Lehigh University, Bethlehem, PA 18015

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Science, Technology & Society

Curriculum Newsletter of the Lehigh University STS Program & Technology Studies Resource Center

Editor
Stephen H. Cutcliffe

No. 90, June 1992
ISSN: 0275-8075

THE TWO STS SUBCULTURES AND THE SOCIOLOGICAL REVOLUTION*

When I was asked to write a few pages on my view of STS Studies in the United States, I thought there was little I could say, and of minimal relevance. What could a Spanish graduate student say about a field of study which is more than two decades old, and why would the readers of *Science, Technology and Society* be interested in it? In my effort to imagine the source of the editor's interest in such a contribution, I came to the conclusion that he was seeking a 'view from the outside.' Then I remembered a genre of writing which developed in Europe during the Enlightenment Period--the voyagers' letters. Exemplified by Montesquieu's *Lettres Persanes*, Oliver Goldsmith's *The Citizen of the World*, and the perhaps less known, but more familiar to me, *Cartas Marruecas*, by the Spaniard José de Cadalso, that literary genre combined the epistolary condition with the tradition of seventeenth-century voyagers' books. In those works, someone from the non-Western world wrote down his or her impressions after a trip to an European country. Enlightened writers attempted to provide a 'virgin' perspective that viewed things more keenly and unveiled truths that habit used to hide, therefore feeling free to issue social criticisms, judgments about European culture and history, and considerations about the customs and character of Europeans. Unfortunately, I have neither such an acuteness of vision nor that special unveiling ability. Therefore, my comments are less a foreigner's impressions after a trip to the U.S. than the reflections of a sympathizer with the STS movement who has been observing certain current trends within it. However, I would like to share the Enlightened ideal of impartiality: an expression of my optimism regarding STS Studies, but an optimism which is not incompatible with a critical perspective.

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* *Editor's Note: Juan Ilerbaig recently concluded a three-month tour of STS programs in the United States, subsequent to which I recruited him to write the following brief impression of the field. He wishes to thank Carl Mitcham and the people at the Pennsylvania State University STS Program for their kindness and hospitality during his stay there, and he expresses gratitude to the University of Valencia for funding his visit to the Program. He is currently pursuing research on STS education for a project funded by the government of Navarra.*

My knowledge about STS programs in the U.S. comes from different sources. I first learned about STS programs at a conference titled "Science, Technology, Society, and Public Policy," held in Valencia, Spain, in June 1989. Stephen Cutcliffe, Paul Durbin, Carl Mitcham, Leonard Waks, and Langdon Winner were among the participants who spoke for the first time in Spain about STS Studies. Last fall I visited the STS Program at the Pennsylvania State University for three months and also had the opportunity to visit other STS programs, including Cornell's. The reasons for my trip to the U.S. were in the main two-fold: my participation in an interdisciplinary project aimed at establishing STS in Spain, and for the purpose of completing my graduate studies in an American university (either in a History of Science Department or in a STS program with a strong historical component). Thus emerged the third source of my knowledge of STS programs in the U.S.; I had to learn about various graduate programs in order to decide where to apply.

C.P. Snow's *The Two Cultures and the Scientific Revolution* (1959)* has been considered a keystone of STS Studies. Snow alerted us about the existence of a split between what he called 'the two cultures': that of the literary intellectuals and that of scientists; or, as we would put it today, humanists and social scientists versus natural scientists and engineers. In his second look at the two cultures problem, he even foresaw the emergence of a third culture, exemplified by a group of social historians, economists, sociologists, political scientists, policy analysts, and others concerned with the human effects of what he called the 'scientific revolution' (Snow 1964). This third culture foreseen by him is what we know today as the STS community.

I want to point out here what I find to be two closely interrelated facts: that a split in this 'third culture' exists, and that a 'sociological revolution' is taking place within it. As I will argue, those two facts are interrelated because some features of the sociological revolution, as well as many reactions to it, are fueling a trend toward a separation between these two STS subcultures.

THE TWO STS SUBCULTURES

In Spain, I was surprised when I found out that there were certain well-differentiated groups of scholars working within the broader context of STS but without the kind of intellectual relationship reflected in bibliographical cross-referencing. People working within the sphere of science education, scholars doing research in the area of science and technology studies (mainly sociologists), and scholars whom we can probably identify as those working within the National Association of Science, Technology and Society framework (many of them philosophers of technology) spoke about STS issues almost as if the other groups did not exist. This differentiation made me think that either the disciplinary barriers were still stronger and higher than many advocates of interdisciplinary studies would like to recognize, or there were other barriers higher and stronger than those acting as boundaries between disciplines.

The literature of STS as a field of study suggests certain divisions among STS programs and approaches that have been highlighted by STS theorists and practitioners. First, there is a distinction between two generations of STS coursework, which has been pointed out by Stephen H. Cutcliffe: a first generation "which used readings from the works of Mumford, Ellul, Toffler, and others," with programs "located at institutions with engineering colleges and often within those colleges themselves," and with its main efforts "directed toward educating science and engineering students about the 'true' societal

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* *For complete citations of publications mentioned in this article, see page 6.*

impact of their work"; and a second generation, which emerged as a response to the interest shown by liberal arts students interested in such questions, and which "took as its approach a social process interpretation of science and of technology. Both were seen as shaped and influenced by societal values, which were, in turn, affected by scientific knowledge and technological innovations." Cutcliffe also mentions the emergence of a third generation, "aimed at developing 'literacy' on the part of liberal arts students in technology, rather than merely about technology" (Cutcliffe 1990: 362-63). Another closely related distinction concerns the origins of the STS programs. Carl Mitcham (1989) has indicated a bipolarity in STS programs, determined by whether their origins were linked to a social science perspective or to an engineering one.

I thought that the differences stressed by Cutcliffe and Mitcham were only references to the past history of the field, but I have since come to realize that it is not exactly so. Some scholars have recently pointed to the existence of variations in the institutional organization and the level of interdisciplinarity in the field (Fuller and Raman 1991). Perhaps some of the more important divergences are related to the different role and aims of STS in undergraduate and graduate levels--either a broad education or expertise in a field of academic knowledge. However, I think that there exists a more substantial intellectual gap regarding the philosophy of STS Studies (what STS should be) not only grounded on those differences, but going beyond them as well. On the one side, we find those who understand the mission of STS as that of providing an "integrative general education" in the era of the technological society (Foltz and Roy 1988), an education able to promote "scientific and technological literacy in order to empower citizen participation in democratic decision-making and action processes for resolving the pressing, technologically-dominated problems of our late industrial society" (Waks 1989: 201). On the other side, we face those who think that the mission of STS Studies is the provision of "integration and coherence to the study of developments in various disciplines that have subfields concerned with science and technology" (Rouse and Wilkes 1991: 41), or even those who identify the acronym STS with 'science and technology studies' (Lynch, et. al. 1991). Scholars placed at both sides of the gap differ essentially on how they conceptualize the relationship between science, technology, and society. Those who emphasize the educational and participatory aspects usually point out that today's social issues are mainly related to scientific and technological developments, while the other scholars tend to stress that science and technology are constitutively social enterprises.

How do these differences translate into course offerings and educational practices? How do they lead to different educational approaches? Ina Spiegel-Rösing distinguished two perspectives from which the interrelationships of science, technology, and society have been conceptualized and studied by scholars: science policy studies, which are issue oriented, and social studies of science, which approach science from the perspectives of other disciplines (philosophy, history and sociology of science). Thus, based on that distinction, science educator Dorothy Rosenthal finds two approaches to S-T-S education: one which is "based on social issues and, like science policy studies, deals with specific topics or problems in science, technology and society; [and] another...that parallels the social studies of science and uses the perspectives of other disciplines to study the interactions among science, technology and society" (Rosenthal 1989: 581-82).

The 'social issues' approach was the one originally used in the field and, perhaps, the one that more accurately reflects the aims and goals of its founders. We should remember that people like Rachel Carson, Ralph Nader, John Kenneth Galbraith, and Theodore Rozsak were not practitioners of the field that today is often pointed out as the 'core' of STS programs: science and technology studies (i.e.: non-traditional approaches of philosophy, sociology, and history of science and

technology, plus some knowledge from fields like rhetoric, anthropology, economics, political science, and psychology (Lynch, et. al. 1991). The separation between an issue-orientation that characterizes true interdisciplinarity and a disciplinary orientation that can only be a sign of multidisciplinarity is at the base of the split to which I am pointing. This separation, along with at least three other dichotomies I want to mention, defines the split between two subcultures in the STS domain. The dichotomies include the following:

Emphasis on technology and technological controversies;	vs.	emphasis on science.
Characteristically normative or evaluative approaches;	vs.	mainly descriptive approaches.
'Leadership' of philosophy of technology and engineering ethics;	vs.	'leadership' of sociology of science.

These two subcultures reflect, to some extent, the generational turn mentioned by Cutcliffe, as well as the origin-related bipolarity highlighted by Mitcham. My point is that the communication between these two subcultures as embodied in different programs seems to be scant, and their coexistence, when it occurs, can hardly be considered peaceful. I think that these dichotomies, as well as the general differences in approach as stated by Rosenthal, are quite clear if we compare programs like those at the Pennsylvania State University and at the University of California-San Diego.

The courses of the Pennsylvania State University's STS Program reflect the ideals that gave birth to the field. They deal with such issues as the American food system, nuclear waste, U.S. technological decline, the greenhouse effect, health and healing, artists in the technological society, or engineering ethics. In contrast, the program at the University of California-San Diego offers courses on *Topics in the History of Earth, Ocean and Atmospheric Sciences*; *Relativism and the Sociology of Science*; *Historical Sociology of Science*; *Sociology of Technology*; *Cultural Sociology of Science*; *Philosophy of Biology*; *Philosophy of Physics*, etc. Whereas in the former program we can clearly notice a characteristic issue orientation, most of the titles of San Diego's courses refer directly to disciplines or subdisciplines in the field of Science and Technology Studies. Other programs, like those at Cornell University and M.I.T., seem to be more balanced. Although their approach is more disciplinary than focused on social issues, their course offerings show a strong interest in ethical, policy, and managerial issues that go beyond the traditional historical, sociological, and philosophical approaches.

THE SOCIOLOGICAL REVOLUTION

The three dichotomies I listed above are related to the confluence of two facts: the spread and even preeminence of the constructivist approach originally developed primarily by European sociologists of science in the field of science and technology studies, and the hiring of many of those sociologists by STS-type programs in the U.S.

In 1945, Robert K. Merton mentioned "the recent transfer of European sociological thought by sociologists who have lately come to this country. To be sure, these scholars were among the culture-bearers of *Wissenssoziologie*." According to Merton, "American thought proved receptive to the sociology of knowledge largely because it dealt with problems, concepts, and theories that are increasingly pertinent to our contemporary social situation..." (Merton 1973 [1945]: 8). That was written almost fifty years ago, but the similarities of the situation described by Merton and what is nowadays happening within the STS community in the U.S. are striking. We only have to put the word 'scientific' between 'sociology of' and 'knowledge'.

In my opinion, the central role that the new sociology of science currently plays in Science and Technology Studies is leading to a change of focus in many STS programs, especially those having European sociologists of science, or their American followers as faculty members. The founders of the STS field previously centered their criticisms on technological issues from an evaluative perspective; however, the influence of the new sociologists of science is more conducive to a focus on science from a descriptive perspective. Again, a look at Penn State and San Diego's programs is enough to see these differences concerning orientation and focus.

Of course, some sociologists have tried to apply the developments in the sociology of scientific knowledge to technology (Bijker, Hughes and Pinch 1987; Elliott 1988). And some scholars have mentioned the need to go beyond merely descriptive accounts in current Science and Technology Studies, taking benefit from the knowledge acquired during the last decades in the field (Bartels 1985; Johnston 1984). Nonetheless, there are only a few works of the first type, and calls of the second kind seem not to have been heard yet.

The lack of communication and the strong differences in interests are features of both sides. While in programs like those at San Diego and Cornell science and technology studies, especially sociology, are not only the core but almost the totality of the program, during the time I spent at Penn State, I seldom heard about scholars like Latour, Pinch, Shapin, Woolgar, Callon, or other sociologists of science and technology. I even talked to graduate students who have never heard of them.

I think that a recent exchange of criticisms between sociologists and philosophers of technology can be taken as representative of my views on how the sociological revolution has affected the gap between the two STS subcultures. (The fact that we cannot call it a debate is, I think, a sign of my general point in these pages.) Instead of seeing each other as complementary scholars and taking benefit from such a complementarity, they look for each other's faults. Sociologists blame philosophers for not having been able to develop fruitful methodological frameworks for the understanding of the origins and development of technological artifacts, systems, or processes (Pinch and Bijker 1984; Woolgar 1991). Philosophers, in turn, defend themselves by accusing sociologists of their inability to work out evaluative approaches on technology, approaches dealing with technology's social consequences and based upon moral and political argument (Winner 1991). While both sides are largely correct in their observations, neither of them takes the necessary steps to overcome the deficiencies highlighted by the other, to say nothing of engaging in a constructive dialogue.

In my opinion, the dangers we face deserve our immediate attention. On the one hand, we are unnecessarily restricting the tools available for addressing STS issues; on the other hand, we are perhaps missing the possibility of utilizing in practice the interpretative arsenal that scholars in the field have been setting up for years. STS practitioners have often seen their task as that of bridge builders. Today, I find that the STS community is divided in its building practices. Whereas some are building strong bridges that perhaps lead nowhere, others are putting up weaker bridges because they refuse to use some of the new materials available. This is neither a call to be less critical with new developments in the area, nor a plea for homogeneity. It is, however, an invitation to be as constructive and open-minded as were those who founded the field more than twenty years ago.

--- Juan F. Ilerbaig
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31006 Pamplona, Spain

REFERENCES

Bartels, Ditta (1985). "It's Good Enough for Science, But Is It Good Enough for Social Action?" *Science, Technology and Human Values*, 10 (4): 69-74.

Bijker, Wiebe E., Thomas P. Hughes, and Trevor J. Pinch (eds.) (1987). *The Social Construction of Technological Systems*. Cambridge, MA: M.I.T. Press.

Cutcliffe, Stephen (1990). "The STS Curriculum: What Have We Learned in Twenty Years?" *Science, Technology & Human Values*, 15 (3): 360-72.

Elliott, Brian (ed.) (1988). *Technology and Social Process*. Edinburgh: Edinburgh University Press.

Foltz, Franz and Rustum Roy (1988). "Postsecondary Science for Nonscientists: STS, the New Approach to the Largest Population," In S. K. Majumdar, L. M. Rosenfeld, P. A. Rubba, E. W. Miller, and R. F. Schmalz, (eds.) *Science Education in the United States: Issues, Crises, and Priorities*. Easton, PA: Pennsylvania Academy of Sciences, 1991, pp. 209-29.

Fuller, Steve and Sujatha Raman (eds.) (1991). *Teaching Science and Technology Studies: A Guide for Curricular Planners*. Blacksburg, VA: Science Studies Center, Virginia Polytechnic Institute and State University.

Johnston, Ron (1984). "Controlling Technology: An Issue for the Social Studies of Science," *Social Studies of Science*, 14: 97-113.

Lynch, William, Sujatha Raman, Joseph Rouse, and John Wilkes (1991). "STS as a Discipline: Graduate Programs," in Fuller and Raman (eds.) (1991): 47-60.

Merton, Robert (1973 [1945]), "Paradigm for the Sociology of Knowledge." In *The Sociology of Science*. Chicago, IL: The University of Chicago Press, pp. 7-40. [Originally appeared as "Sociology of Science" in *Twentietn Century Sociology*, Georges Gurvitch and Wilbert E. Moore, (eds.) New York: Philosophical Library, pp. 366-405.]

Mitcham, Carl (1989). "In Search of a New Relation Between Science, Technology and Society," *Technology in Society*, 11 (4): 409-17.

Pinch, Trevor and Wiebe E. Bijker (1984). "The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other," *Social Studies of Science*, 14: 399-441.

Rosenthal, Dorothy (1989). "Two Approaches to Science-Technology-Society (S-T-S) Education," *Science Education*, 73 (5): 581-89.

Rouse, Joseph and John Wilkes (1991). "STS as a Discipline: STS Undergraduate Programs," in Fuller and Raman (eds.) (1991): 40-47.

Snow, Charles P. (1964). *The Two Cultures and A Second Look. An Expanded Version of The Two Cultures and the Scientific Revolution*. New York: Cambridge University Press.

Waks, Leonard J. (1989). "Critical Theory and Curriculum Practice in STS Education," *Journal of Business Ethics*, 8: 201-7.

Winner, Langdon (1991). "Upon Opening the Black Box and Finding It Empty: Social Constructivism and the Philosophy of Technology." In J. C. Pitt and E. Lugo, (eds.) *The Technology of Discovery and the Discovery of Technology*. Blacksburg, VA: The Society for Philosophy and Technology, pp. 503-19.

Woolgar, Steve (1991). "The Turn to Technology in Social Studies of Science," *Science, Technology & Human Values*, 16 (1): 20-50.

COURSE SYLLABUS

HISTORY OF AMERICAN TECHNOLOGY

Hist. 455
Office hours by appointment only
406-994-2042

Corlann Gee Bush
History Department
Montana State University

Course Description: The interrelationships among society, technology, and history are complex, dynamic, and value laden. Cultural, political, and economic values help to shape and direct technological development; technologies affect and alter these values; historians struggle to make sense of variables that are too complex, too fluid. In this course, we will explore technology as a force in American history and examine the ways technology shaped American values and was, in turn, molded by them.

This course will be conducted in a mixed lecture/discussion format which I hope will evolve into a seminar before the end of the semester. As much as possible, I plan to devote 50 minutes to the presentation and discussion of material and 25 minutes to in-class activities and discussion. Students will be expected to read assignments and come to class prepared to discuss the readings, assignments, and class activities.

Purpose: The purpose of this course is to explore issues in the history of American technology, paying particular attention to technological change as experienced by ordinary people, workers, women, children, immigrants, farmers, ranchers, etc. In addition, students enrolled in this course will learn and engage in a method of writing history that relies upon oral history and contextual analysis to reveal the human "underside" of mechanization and industrialization.

Required text:

Alan Marcus and Howard Segal, *Technology in America: A Brief History* (New York: Harcourt, Brace, Jovanovich, 1989).

You will need to have access to a tape recorder with audio tapes. In addition, you will be expected to read other materials that are on reserve in the Library or which will be distributed in class. You will be expected to organize these readings so they will be useful to you throughout the course.

Grading: Grades will be based on class participation, including team work and peer interactions, including free writing exercises and ad hoc assignments, a mid-term exam, a final exam, and a major paper/class presentation as follows:

Mid-term Examination	15%
Paper/Class Presentation	45%
Final Examination	20%
Class Participation	20%

Expectations For Paper/Class Presentation: The paper and corollary in-class presentation are, together, worth 45 points and are the most significant assignment in this course. You will be expected to:

- Identify a specific technology, tool, or technique that is in general use today or which has recently been in general use.
- Conduct library research to identify at least five significant sources of information about the chosen technology. These should be presented in an annotated bibliography due on February 11. At least one source should discuss the design context of the technology. (5 points).
- Use the technology yourself and construct a brain map and effects wheel identifying (anticipated) effects of this technology on the user, environmental, and/or cultural contexts. Due February 20. (5 points).
- Select and interview at least three individuals who commonly use the technology. Names of interviewees due February 20.
- Complete interviewing and "significant excerpting." Due March 24. (5 points).
- Select one brief reading for the class to read before your class presentation. Make sure 3 copies of this reading are on reserve in the library. Make one copy available to me. Due March 31.
- Write a paper (10 pages) analyzing the history of the selected technology in terms of its effects on the design, user, environmental and cultural contexts, citing your interviews and references. Due April 7 (15 points). Other forms of expression such as edited audio tapes with photographs or videotapes may be substituted for the written paper, with permission.
- Present a lecture and lead class in a discussion of the history of the technology you have selected. Presentation should be 15-20 minutes; expect to lead at least a 10-minute class discussion. (You will be asked to sign up for one of three slots on April 7 through 21. Sign up on February 27). (15 points).

COURSE OUTLINE

Date	Topics and Readings
Jan. 16	VIDEO: *The Gods Must Be Crazy* Assignment: Write a brief technological autobiography on the order of *TGMBC*.
Jan. 21	INTRODUCTION: Course focus, purpose, and expectations. DISCUSSION: What does the film *The Gods Must Be Crazy* tell us about technology? Why is it funny? Is it a cautionary tale? Read: Eugene S. Ferguson, "The American-ness of American Technology," *Technology and Culture* 25 (January 1979): 3-24. Witold Rybcynski, "Technology Isn't Everything," *Taming The Tiger: The Struggle To Control Technology* (New York: Viking Press, 1983), pp. 195-211.
Jan. 23	LECTURE/DISCUSSION: Chinese Puzzles/Ancient Ways: The Interaction of Cultural Values, Technology and History. Read: Corlann Bush, "To Think, to Be, To Unthink, To Free: Women and the Assessment of Technology," in Joan Rothschild, *Machina Ex Dea: Feminist Perspectives on Technology* (New York: Pergamon, 1983), pp. 151-70.
Jan. 28	LECTURE/DISCUSSION: Principles and Assumptions Underlying Technological History. Read: Effects Wheel and Cross Impact Matrix (handout). Assignment: Select 4 or 5 technologies you are considering researching for your paper and class presentation.

Jan. 30 LECTURE/DISCUSSION: Techniques for Historical Analysis of Technological Change.
Read: Joan Jensen, "Native American Women and Agriculture," in Ellen Carol DuBois and Vicki L. Ruiz, eds., *Unequal Sisters: A Multi-Cultural Reader in U.S. Women's History* (New York: Routledge, 1990), pp. 51-64.

Feb. 4 GUEST LECTURE: Dr. Les Davis. Native American Technologies.
VIDEO: *Koyaanisqatsi*
Read: Marcus, *Introduction*, pp. iii-v; pp. 315-17. Review of Marcus (Handout).

Feb. 6 FIELD TRIP TO THE LIBRARY.
Read: Marcus, Chapter 1 and 2.
Assignment: Develop an annotated bibliography of at least five sources you will potentially consult in developing your paper.

Feb. 11 LECTURE/DISCUSSION: Colonial Technologies: The Legacy of Mercantilism.
Read: Corlann Bush, "'He Isn't Half So Cranky As He Used To Be': Agricultural Mechanization, Comparable Worth, and the Changing Farm Family." in Carol Groneman and Mary Beth Norton, eds., *"To Toil the Livelong Day": American Women at Work, 1780-1980* (Ithaca, N.Y.: Cornell Univ. Press, 1987), pp. 213-29.

Feb. 13 LECTURE/DISCUSSION: "You Are What You Eat": Agricultural Technologies.
Read: Marcus, Chapter 3.
Ava Baron and Susan E. Klepp, "'If I Didn't Have My Sewing Machine...': Women and Sewing Machine Technology," in Joan Jensen and Sue Davidson, eds., *A Needle, A Bobbin, A Strike: Women Needleworkers in America* (Philadelphia, Penna.: Temple Univ. Press, 1984), pp. 20-59.

Feb. 18 LECTURE/DISCUSSION: "You Are What You Wear": Technology, Industrialization, and the Textile Industry.
Read: Marcus, Chapter 4.
Assignment: Brain maps and anticipated effects wheel.

Feb. 20 LECTURE/DISCUSSION: "You Are What You Wear": Industrialization of the Clothing Industry.
Read: Marcus, Chapter 5.
Assignment: Complete at least one hour of oral history interviews on the user, or the environmental or cultural context of the technology you have chosen to study.

Feb. 25 MID TERM EXAM.
Read: Marcus, Chapter 6.
Merritt Roe Smith, "Eli Whitney and the American System of Manufacturing," in Carroll W. Pursell, ed., *Technology in America: A History of Individuals and Ideas* (Cambridge, Mass.: MIT Press, 1981), pp. 45-61.

Feb. 27 LECTURE/DISCUSSION: The American System of Manufacture and the Industrial Revolution.
Read: Marcus, Chapter 7, pp. 257-89.
Philip Scranton, "Learning Manufacture: Education and Shop Floor Schooling in the Family Firm," *Technology and Culture* 27 (January 1986): 40-62.

March 3 LECTURE/DISCUSSION: The Industrial Revolution and the Labor Movement.
VIDEO: *Modern Times*.
Read: Martin V. Melosi, "Energy Transitions in the Nineteenth-Century Economy," in George H. Daniels and Mark H. Rose, eds., *Energy and Transport: Historical Perspectives on Policy Issues* (Beverly Hills, Calif.: Sage, 1982), pp. 55-69.

March 10 GUEST LECTURE: Dr. Franke Hess, "Making of the Modern Age." Modernism.
Assignment: Select the short reading you will ask students to read in preparation for your class presentation and make three copies available on reserve.

March 12 LECTURE/DISCUSSION: The Making of the Modern Age: The Evolution of Energy.
Read: James J. Flink, "The Family Car," in *The Automobile Age* (Cambridge, Mass.: MIT Press, 1988), pp. 158-68.
Assignment: See film *American Graffiti* over Spring Break.

March 16-20 MID-SEMESTER BREAK.

March 24 LECTURE/DISCUSSION: The Making of the Modern Age: American Car Culture.
Read: Jean Christie, "Morris L. Cooke and Energy for America," in Carroll W. Pursell, ed., *Technology in America: A History of Individuals and Ideas* (Cambridge, Mass.: MIT Press, 1981), pp. 202-12.
Freewrite: "*American Graffiti* as a history of American car culture."
Assignment: Complete oral history interviews/complete "significant excerpting."

March 26 LECTURE/DISCUSSION: The Making of the Modern Age: Electricity, Electronics, and Communications Technologies.
Read: Marcus, Chapter 7, pp. 289-314.

March 31 NATIVE AMERICAN AWARENESS WEEK PRESENTATION:
G. G. Kipp, "Sacred Places: Conflicting World Views."

April 2 NATIVE AMERICAN AWARENESS WEEK PRESENTATION:
Alma Snell, "Native Uses of Medicinal Plants."

April 7 ALL PAPERS DUE. STUDENT PRESENTATIONS.

April 9 STUDENT PRESENTATIONS.

April 14 STUDENT PRESENTATIONS.

April 16 STUDENT PRESENTATIONS.

April 21 STUDENT PRESENTATIONS.
Read: Christine Bose, Philip Bereano, and Mary Malloy, "The Social Construction of Housework," *Technology and Culture* 25 (January 1984): 53-82.

April 28 LECTURE/DISCUSSION: "...And a Woman's Work is Never Done": Housekeeping and Domestic Technologies.
Read: Marcus, Chapter 8, pp. 315-28.

April 30 LECTURE/DISCUSSION: The Unmaking of the Modern Age: Post Modernism and the Post Industrial State.
Read: Marcus, Chapter 8, pp. 328-41.

May 5 LECTURE/DISCUSSION: The Unmaking of the Modern Age: Post Modernism and the Post Industrial State (continued).
Read: Marcus, Chapter 8, pp. 341-64.

May 7 VIDEO: *Connections: Yesterday, Tomorrow, and You.*

May 12 FINAL EXAM.

COURSE SYLLABUS

CULTURE AND TECHNOLOGY: A HISTORICAL PERSPECTIVE

EGR 180.A/HST 180.E
Spring 1992

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Course Objectives: This interdisciplinary course is team-taught by two faculty members from the Manufacturing Engineering (School of Applied Science) and History (College of Arts and Sciences) Departments. The major objective of this course is to give students a fundamental understanding of the interrelationship between technology and culture. The students will explore historical beginnings and their association with the cultural views of their own times and identify their impact and similarities with present problems and issues. Accordingly, upon the completion of the course, students will be able to: know and comprehend the role of history in examining current technological issues; synthesize and evaluate the social and cultural shaping of technology; and articulate in speech, discussion, debate, and writing the impact of these complex issues on their life, society, and the world.

The course intends no survey coverage but will draw on significant historical episodes in various cultural and chronological contexts to stimulate critical analysis and discussion. At every point issues of values will be raised to set technology in a broad context of human advantages and disadvantages from various degrees of application of scientific knowledge and technical skills to productive or organizational problems. The question of technology as European or Western means, which supposes cultural advantage or, at various times, disadvantage in world power systems, will be discussed from a wide perspective including other cultures in the world. Likewise, the place of ethnicity and gender in juxtaposition to technology will claim central attention in the course.

This course is designed to be included in the new Miami Plan for Liberal Education that is required of all incoming freshmen starting by the Fall of 1992. Because the Miami Plan requires every course to specify the criteria used to assess the course's success in enhancing students' learning and teaching effectiveness, we recognize two approaches to achieve that: (1) Students participate with the instructors in evaluating the course's success in enhancing student learning and implementing the four basic goals of the Miami Plan--critical thinking, understanding contexts, engaging with other learners, and reflecting and acting. This includes a critique of course materials, teaching methods, and learning modes. (2) End-of-the-course evaluation. The results of these assessments will be shared with other faculty by conducting a seminar following the end of the semester. This will enable us to share ideas and prepare for next year.

Evaluation Procedures: Students will be evaluated by four quizzes: one in class and three take home (50% of the course grade); participation in discussions, presentations, and debates (30%); and a term paper (20%). Presence in class is essential. The grades will be distributed to reflect and emphasize both individual and group work as well as different styles of learning.

Term Paper and Class Presentation: A 10-12 page term paper will count as 20% of the final grade. During the last five weeks of the semester, a portion of each session will be set aside for student presentations. Each student is expected to prepare and present a ten-minute summary of the results of his/her research. This presentation will represent an additional 5% of your final grade. Detailed requirements and a list of suggested topics will be distributed in class.

References and Reading Assignments:

Atwood, M., *The Handmaid's Tale*. New York: Fawcett Crest, 1985.

Eisenman, H. J., "One Culture: Creativity in Art, Science, and Technology," in Elizabeth Garber, ed., *Beyond History of Science: Essays in Honor of Robert E. Schofield*. Bethlehem: Lehigh University, 1990, pp. 284-295.

MacKenzie, D., and Wajcman, J., eds., *The Social Shaping of Technology*. Milton Keynes, England: Open University Press, 1990.

The Miami Plan For Liberal Education, Miami University. Oxford, Ohio 45056. Contact Dr Karen M. Schilling, Director of LE, for more information.

Muller, H. J., *The Children of Frankenstein*. Bloomington: Indiana University Press. 1971.

Snow, C. P., "The Two Cultures and the Scientific Revolution," Rede Lectures, Cambridge University Press, 1959, and "A Second Look," 1963. In *The Two Cultures: and A Second Look*, Cambridge University Press, 1964; or in Mentor Books, 1964, pp. 9-92; or in *Public Affairs*, Charles Scribner's Sons, 1971, pp. 13-46, 47-79.

Schedule and Assignments: The topics are divided between the two instructors according to their expertise and interest. However, they both will attend all periods and participate equally in preparing for the sessions.

PART I. Culture, Technology, and Methods: Establishing the Foundations for Discovery and Learning

1. 1/14 *Course Overview.*
   Syllabus, course procedures, sense of student expectations; discussion of the Miami Plan for Liberal Education and Foundation Courses within the plan. Reading: The Miami Plan.

2. 1/16 *What is Culture?*
   Different definitions of culture and the role of technology in shaping them; "the two cultures: science and the humanities"; cross-cultural transfers; doing versus thinking in Greek civilization; learning styles. Reading: MacKenzie-Wajcman, pp. 2-25, 302-4; Snow, 1964, (Mentor), pp. 9-92, or 1971, (Scribner's), pp. 13-79; Eisenman, pp. 284-95.

3. 1/21 *History of Technology.*
   Overview of technology from antiquity to present; medieval machines; clocks, gunpowder, and print; movement toward industrialism: textiles, metallurgy; stages or phases of industrial technologies; cultural, social, and political assumptions and consequences. Reading: MacKenzie-Wajcman, pp. 39-52, 68-83, and 93-108.

4. 1/23 *History of Technology.* Continuation of 3.

5. 1/28 *Debate #1: The Two Cultures.*
   This session will engage students in a debate about the given topic. The class will be divided into four groups: one represents Snow's arguments, another Eisenman's views, the third is jury, the fourth is the media, who, along with the instructors, will moderate the debate. The media will prepare a short summary of the whole exercise. Reading: Snow, 1964, (Mentor), pp. 9-92 or 1971, (Scribner's), pp. 13-79; and Eisenman, pp. 284-95.

6. 1/30 *Assessment: Exercise In Active Learning.*
   Student-instructor assessment of class activities including first quiz, course evaluation of applicability to the Miami Plan, evaluation of instruction, and quality of classroom discussions.

PART II: World Cultures and Technology

7. 2/4 *A Historical Perspective.*
The relationship between culture and technology as driving mechanisms for change: examples from past or contemporary circumstances. Each student will research a specific topic on the subject and discuss it in class. Reading: MacKenzie-Wajcman, pp. 165-72.

8. 2/6 *Neolithic Village and Agriculture.*
Parallels to previous discussion but with a focus on specific beginnings of technology, its relation to agricultural development, impact on society, and division of labor. Egypt will be the focus of this study. Reading: Muller, pp. 15-29; MacKenzie-Wajcman, pp. 84-92, 302-4.

9. 2/11 *Neolithic Village and Agriculture.* Continuation of 8.

10. 2/13 *Experimentation: Learning with Tools and Toys.*
With this class comes a shift of teaching methods from lecture-discussion to experiments; use of toys to illustrate the engineering design process and to develop analytical and critical skills in making decisions, asking questions, developing contexts and constraints, and recognizing cultural impacts. Reading: Mackenzie-Wajcman, pp. 109-24.

11. 2/18 *Experimentation: Learning with Tools and Toys.* Continuation of 10.

12. 2/20 *Exercise In Learning and Assessment.*
Presentation of students' results from 11; discussion of the values of such exercises in learning; implications of developed designs for "two cultures" notion. Take home quiz #2.

Part III. Culture, Technology and the Military

13. 2/25 *History of War and Weapons.*
Overview of part III and links to previous parts; history of weapons; ethics and morality of military technology; politics of weapon technology's control as means to control the world. Reading: MacKenzie-Wajcman, pp. 224-94; Muller, pp. 105-25.

14. 2/27 *History of War and Weapons.* Continuation of 13.

15. 3/3 *Technology, Research and Star Wars.*
Views on research, technology, and Star Wars or Strategic Defense Initiative; background, differing views, current impacts on world cultures, myth and historical parallels. Reading: Muller, pp. 126-46, 210-41.

16. 3/5 *Debate #2: Culture and War.*
The Arab-Israeli conflict from a historical perspective and cultural attitudes. The scene is in the U.N. where the two sides are negotiating a peaceful solution. The alternative, if the negotiation fails, is war. Same organization as in Debate #1. Each group will take a specific side (even if they do not like it) and defend it before the other group. The assignment presumes results but not necessarily solutions.

17. 3/10 *Field Trip to Wright-Patterson Air Force Museum.* Objectives are not merely visual but reflective, raising questions about lessons or trends possibly projected into the future.

18. 3/12 *Assessment and Learning: Discussions.* Take home quiz #3; review of Part III: what did we learn and where to go from here? Evaluation of classroom activities and discussions.

PART IV: What does Society Want from Technology?

19. 3/24 *History of the Mechanization of Homes.*
Brief review tracing mechanization; domestic appliances; effect on family structure and relations; perspectives of several cultures and settings. Reading: MacKenzie-Wajcman, pp. 174-218, and Atwood.

20. 3/26 *History of the Mechanization of Homes.* Continuation of 19.

21. 3/31 *Changing Roles for Women and Men from Mechanization.*
Concentrate on the effect of mechanization on gender roles. Reading: MacKenzie-Wajcman, pp. 53-65, 125-64, 219-22, and Atwood.

22. 4/2 *Transportation History: Views and Consequences.*
Explore transportation and its relation to communication and their cultural effects on society Start student presentations: "Robots, Society, and Technology;" and "Historical and Cultural Shaping of Mass and Lean Production." Reading: Muller, pp. 278-94.

23. 4/7 *Debate #3: Freedom From and Freedom To.*
In this debate, we will create the imaginative and fictitious city of Gilead. The scene is a neutral country with two groups, one representing Gilead and the other escapees. The escapees have taken asylum in the neutral country, and the Gilead group wants the escapees back. What do we do about it? Reading: Atwood.

24. 4/9 *Assessment and Evaluation.* Take home quiz #4, and evaluation of part IV: what did we learn? Student presentations: "Culture, Technology, and Sweatshops;" "Communication, Culture, and Technology;" and "Telecommunications."

PART V: Politics of Technology and Nature

25. 4/14 *History of Human and Nature: Exploitation or Harmony.*
Exploration of various issues, particularly harmonious and exploitative transactions between humankind as technologist and nature. Student presentations: "Ethics and Technology," and "Nature and Technology." Reading: MacKenzie-Wajcman, pp. 26-38, 75-83, 165-72.

26. 4/16 *Student Presentations.*
"Ethics and Technology," and "History of the Military and Technology."

27. 4/21 *Student Presentations.*
"Ethical Issues in Modern Medicine," and "College Students and World Affairs."

28. 4/23 *Student Presentations.*
"Paper Making and the Environment," and "History of Technology in the Military."

29. 4/28 *Debate #4: Ethics, Technology, and Nature.*
This debate simulates a town meeting somewhere in the U.S. Two groups: environmentalists and business people, are debating issues related to nature, technology, and ethics. For example: jobs and birds' rights, polluting the environment, animal rights and medical research, creating energy and ecology, economics, etc. What do we do about it?

30. 4/30 *Final Review and Course Critique.*
Continue student presentations: "The Beer Brewery Industry," and "Music Technology and Culture in Europe." Critique of the course; learning process; its applicability to the Miami Plan.

A VISIT TO CHILE

The 16th biennial conference of the Consejo Latinoamericano de Ciencias Sociales (CLACSO) recently took place in Santiago, Chile, November 25-29, 1991. This meeting of approximately 500 social scientists from throughout Latin America (with some representation from Europe and North America) was an occasion for celebrating the return to democracy in Chile — CLACSO had not met there since 1973 in protest against the Pinochet regime — and for vigorous discussion of issues related to science, technology, and society studies. As an invited participant from the United States, I would like to provide a brief report on these discussions with a comment on the importance of STS Studies to Latin America.

The single most impressive thing about the conference was the political common sense and integrity of our Chilean hosts. The conference opened with a plenary session in which Ricardo Lagos, the Minister of Education, reviewed the current situation of the social sciences in Chile. In this presentation he stressed how, although the political right had done many bad things during the Pinochet years, the political left (of which he was a representative) also had to take some responsibility for the difficulties in Chile. It was not enough to point the finger at others. In the course of my visit I was to find similar views expressed by persons on the political right. (By contrast, when I returned to the U.S., my first national news included George Mitchell blaming Bush for unemployment and President Bush blaming the Democrats for the bad economy. I could not help but note that the political culture was more honest and self-critical in a so-called underdeveloped country.)

The conference was organized around series of round table discussions on such topics as "Latin America and Modernity," "International and Domestic Processes of Integration," "Scientific-Technological Transformations and Social Reforms," and "New Forms of Mass Culture." During the fourth day there were collateral symposia on more specific aspects of science, technology, politics, culture, and society.

For a bit more detail on the character of these diverse colloquia, consider the round table for which I did a paper on issues associated with the problems of sustainable development. Also presenting were José Sanmartín (University of Valencia, philosophy) on bioengineering and Tullio Regge (University of Turn, physics) on science and society. These presentations were complemented with commentaries by Isabel Licha (Central University of Venezuela, engineering and social sciences) and Judith Shutz (Research and Studies Center of Uruguay, engineering and social sciences).

The background of Licha and Shutz, and the presence of a good proportion of women scholars, was typical of the challenging character of CLACSO as a whole. Both Licha and Shutz earned bachelor degrees in engineering in Venezuela and Uruguay, respectively, followed by doctorates in the sociology of development from the University of Paris.

During two associated colloquia organized by Eduardo Sabrovsky (Director of the Academic Program in Science, Technology, and Society of the Latin American Institute of Transnational Studies in Santiago, who again has degrees in both engineering and philosophy), STS studies were topics of explicit discussion. The one session, held at the Catholic University of Chile, dealt with STS in the university. The other sessions, at the National Library, dealt with technology and politics, and were an occasion for lively discussion of development, the non-neutrality of technology, engineering ethics, and related topics.

Although the term STS is not common in Latin America (with the exception of Brazil), once introduced it was readily understood. Indeed, the time is ripe for the pursuit of broader and deeper connections between the U.S., Europe, and Latin America on the basis of common STS concerns.

--Carl Mitcham, Director
STS Program, Pennsylvania State University

OPEN FORUM

NEH HUMANITIES, SCIENCE AND TECHNOLOGY GRANT OPPORTUNITIES

The National Endowment for the Humanities is pleased to announce the availability of grants under the program of Humanities, Science and Technology for the support of research that brings to bear the knowledge, methods, and perspectives of the humanities on the subjects of science, technology, or medicine. Historical studies and studies of current topics are eligible. However, studies of current science, technology, or medicine must deal with fundamental issues in the humanities. Individuals and institutions are eligible to apply. Applicants may request support for full or part-time salaries, travel, and other costs of conducting research for periods of from one to three years. This category of support is for projects that, because of their intellectual scope and consequent size, duration, or complexity, cannot be accomplished through individual one-year fellowships. Application materials are available from Daniel Jones, Program Officer for Humanities, Science and Technology, Room 318, National Endowment for the Humanities, Washington, DC 20506, or call (202) 786-0210. The next deadline for receipt of applications is October 15, 1992.

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NEW JOURNALS

Perspectives on Science: Historical, Philosophical, Social, a new interdisciplinary quarterly journal to be published by the University of Chicago Press, is being founded "to give voice to a range of viewpoints on science in all historical periods" with the intent of providing "an integrated approach that will benefit all scholars of science." The first issue is scheduled to appear Spring 1993. Subscriptions are available at $29.00--for individuals; $59.00--for institutions; and $21.00--for students. Manuscript submissions are encouraged. Contact: Joseph C. Pitt, Editor, *Perspectives on Science*, Department of Philosophy, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-4564; Phone: (703) 231-4565; FAX: (703) 231-7826; BITNET: POS@VTVM2.

Configurations: A Journal of Literature, Science, and Technology is the new scholarly journal of the Society for Literature and Science. It will be published 3 times per year (January, May, and September) by Johns Hopkins University Press. The title *Configurations* suggests the cultural and social shaping or "configuring" of science and technology. *Configurations*' academic and interpretive communities include: the history, sociology, anthropology, rhetoric, and philosophy of science, technology, and medicine; literary history and criticism; art history and media studies; the cognitive sciences; and other researchers and practitioners in all areas of science, technology, and medicine. S.L.S. membership, including a subscription to *Configurations*, is available for $33.00--for individuals and $18.00--for students. The Editors invite submissions of articles and proposals. Write to: *Configurations*, Editorial Office; School of Literature, Communication, and Culture; Georgia Institute of Technology; Atlanta, GA 30332-0165.

FORTHCOMING MEETINGS AND CONFERENCES

October 9-10, 1992. *Interface '92, Sixteenth Annual Humanities and Technology Conference*, Marietta (metro Atlanta), Georgia. Contact: Mark Stevens or Pamela McMahon, Dept. of Humanities and Social Sciences, Southern College of Technology, 1100 S. Marietta Parkway, Marietta, GA. 30060-2896; Phone: [404] 528-7202.

October 8-11, 1992. *Society for Literature and Science*, Atlanta, Georgia. Contact: Pamela Gossin, History of Science Dept., 601 Elm, Room 622, Univ. of Oklahoma, Norman, OK. 73019.

October 17-21, 1992. *ECO-ED--World Congress for Education and Communication on Environment and Development*, Toronto, Canada. Conference portion of Congress organized by the North American Association for Environmental Education and other institutions. Contact: ECO-ED Secretariat, 110 Eglinton Ave., W., 3rd Floor, Toronto, Canada M4R 1A3; Phone: [416] 482-9212; FAX: 416-482-9601.

October 28-30, 1992. *New Conditions and Challenges for Research in Science and Technology*, Mexico City, Mexico. Organized by National Univ. of Mexico (UNAM) in collaboration with the Metropolitan Univ. (UAM). Contact: Miguel A. Campos, IIMAS, UNAM, Apdo Postal 20-726, Admon 20, Del. A. Obregon, Mexico, 01000, Mexico; FAX: 525-550-0047; Bitnet: jjimen.unamvm1.

November 6, 1992. *Technologies of Vision*, Stanford University. A Graduate Student Conference sponsored by the Depts. of Comparative Literature, French and Italian, and the Program of History of Science. Contact: Techno/Vision Conference, Dept. of Comparative Literature, Bldg. 240, Stanford Univ., Stanford, CA 94305-2087; Phone: [415] 856-0948 or 550-7130.

December 26-30, 1992. *History of Science Society Annual Meeting*, Washington, D.C. In conjunction with the American Historical Association. Contact: Executive Secretary, HSS, 35 Dean St., Worcester, MA. 01609.

January 3-8, 1993. *Science Education in Developing Countries: From Theory to Practice*. Jerusalem, Israel. Contact: Avi Hofstein, Dept. of Science Teaching, The Weizmann Institute of Science, Rehovot 76100, Israel; Phone: 972-8-342278; Fax: 972-8-344115; Email: NTHOFSTN@WEIZMANN.

May 21-23, 1993. *VII Biennial Congress of the Society for Philosophy of Technology*, Valencia, Spain. Special theme--"Technology and Ecology"--but papers on other topics are also welcome. Submissions for Symposium papers (30 minutes, 4,000 words); working papers (15 minutes, 2,000 words); and poster sessions, all including 100 word abstracts, due by September 1, 1992. Submit to: Larry Hickman, Dept. of Philosophy, Texas A&M Univ., College Station, TX. 77843-4237.

September 8-11, 1993. *Technological Change*, Rhodes House, University of Oxford, England. Co-sponsored by the British Society for the History of Science. Contact: Robert Fox, Modern History Faculty, Broad St., Oxford OX1 3BD, England. FAX: 086-525-0704.

October 14-17, 1993. *Society for the History of Technology Annual Meeting*, National Air and Space Museum, Washington, D.C. 3 copies of paper and panel proposals, including 150-200 word summaries and vitae for each presenter, should be submitted by Feb. 1, 1993, to Philip Scranton, Center for History of Business, Technology and Society, Hagley Museum and Library, P. O. Box 3630, Wilmington, DE. 19807; Phone: [302] 658-2400.

Readings That Help

This section of the STS Newsletter is meant to guide the reader to books or articles that someone recommended to me because they are useful, provocative, or enjoyable--at best, all three. Suggestions of other materials to be reviewed would be most welcome, with or without comments. But I hope you will feel free to comment on my opinions as well.

Barrett Hazeltine
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Providence, RI 02912

[Editor's Note: Barrett Hazeltine spent this past academic year at the Department of Engineering and Computer Science, Baylor University and wishes to thank them for their support of his efforts as editor of this column. **SHC**]

ADAMS, JAMES L. *FLYING BUTTRESSES, ENTROPY, AND O-RINGS: THE WORLD OF AN ENGINEER*. CAMBRIDGE, MASS.: HARVARD UNIV. PRESS, 1991. 247 P. ILLUS. BIBLIOG. PAPERBACK: $24.95.

Jim Adams has been a leader in making engineering accessible to people who are not engineers and explains that one of the reasons he wrote this book was the relatively small number of readable general books on engineering, as opposed to the large number on science or mathematics. The focus is on what engineers actually do, and Adams draws heavily on his own experiences as a design engineer, contract officer for the Air Force, and professor at Stanford. Engineers design and invent, and the part of the book I enjoyed the most discussed design and invention. Some engineers do manufacturing and assembly, and the country would probably be better off if more did. They use mathematics and interact with scientists, business people, and government regulators. Manufacturing, how engineering relates to mathematics/science, financing, and governmental influences on the practice of engineering, are all discussed. Flying buttresses, if the reader was wondering, were developed in the Middle Ages to help hold up gothic cathedrals. Entropy is a concept, thought about differently by engineers and physicists, measuring the disorder of a system. O-rings are the seals that failed causing the *Challenger* to explode. On the one hand, the design of the book--the graphics and layout--is impressive, but, on the other hand, the editing seems less effective--it is hard to believe a book published by the Harvard University Press would twice indicate that Harvard does not have an engineering program. Adams has read widely--the list of sources and suggested readings will be very helpful. He relates what has been written to his own experiences. This would be a useful book for many people.

BARRY, JOHN A. *TECHNOBABBLE*. CAMBRIDGE, MASS.: MIT PRESS, 1991. 188 P. PAPERBACK: $22.50.

No technology seems as pervasive in everyday life as computer technology and its words--"bit," "clone," "hyper"--and expressions--"It's on my screen!," "desktop publishing," "user friendly"--may become just as pervasive. One would think it helpful to many, both in the computing business and without, to know exactly what terms like "application," "interface," "platform," or "support" mean. Barry thinks none of these really have precise meaning. Some computer words are acronyms--WYSIWYG (pronounced WIZ-ee-wig) is short for "what you see is what you get." Other words are nouns into verbs--the word "format" entered English as a noun in 1840, and the usage "to format" became acceptable to serious dictionary editors in 1964. Evidently no bounds exist on the process of adding suffixes, such as "-ify"--"to MACify." Besides words, technobabble has a grammar, usually in the passive voice, often personifying, often hyperbolic--"super computer," "massively parallel," with lots of capitals--NeXT. The language reflects the history of computing from batch to networks, and the book reviews that history. Part of the history is the folklore--it is said that the Lisa computer was named for the illegitimate daughter of an Apple Computer Company founder and then backwards acronymed (noun into verb) into Locally integrated software architecture. It has been suggested though that the name really stood for "let's invent some acronym." Barry is knowledgeable about the computer business and about words; I never knew "noise" came from the Latin *nausea*. He keeps his cool even when distressed by the excesses of technical or marketing announcements. The book really does give much insight into the growth and *elan* of the computer industry. The glossary and other appendices are valuable--one appendix explains how the French deal with those hated English terms. Good fun and insightful.

LEWIS, THOMAS S.W. *EMPIRE OF THE AIR: THE MEN WHO MADE RADIO*. NEW YORK: HARPER COLLINS, 1991. 362 P. BIBLIOG. PAPEBACK: $25.00.

Readers may have seen the PBS television special based on this book. The book has more, but not much more, about technology and less, but not much less, about the way radio changed people's lives. The story is about the three persons who made the major contributions to radio broadcasting: Lee De Forest, Edwin H. Armstrong, and David Sarnoff. Lee De Forest

invented the vacuum tube amplifier, although many believed he did not understand why it worked. Armstrong invented the receiver now universally used--the superheterodyne--and frequency modulation--FM. Sarnoff started as a telegrapher and was in the technical side of radio before becoming a manager and eventually head of RCA. All three seemed, from the book, to spend nearly as much time in court--generally patent matters, or preparing for trial--as they did inventing or managing. Armstrong and De Forest worked by themselves, with a few assistants, goaded strongly by their pride. The days when such lone inventors can do big things seem to be over in electrical engineering (perhaps they still exist in software design). All three of the protagonists were powerful persons--ambitious, able, and driven--and their characters come out strongly. Ultimately the story is a tragedy: Armstrong, in despair over litigation, jumped from his Park Avenue apartment. De Forest, then married to a fourth wife, died nearly destitute and relatively unknown. RCA disappeared, although not until after Sarnoff died. Only Armstrong's widow, finally vindicated in court, seems successful at the end. Reading this book was a great pleasure.

MAYO, DEBORAH G. AND RACHELLE D. HOLLANDER, EDS. *ACCEPTABLE EVIDENCE: SCIENCE AND VALUES IN RISK MANAGEMENT*. NEW YORK: OXFORD UNIV. PRESS. 279 P. HARDCOVER: $35.00.

If an evaluation of the carcinogenic risk of, say, formaldehyde is to be credible, then people involved must agree on what evidence is compelling--in this case, evidence from studies on rats or epidemiological evidence from humans, more generally, evidence based on either epidemiological or physiological analysis. Part of the problem is that a statistical test can simply indicate that no conclusion can be drawn from the data at hand, which, of course, is very different from saying that the data indicates no risk exists. The question though is more than not understanding the numbers--it involves values--that is, different people perceive risks in different ways. It may be expedient for professional analysts to use a single parameter, such as the number of additional annual fatalities per 100,000 persons, as a measure, but the general populace (who would appear to be more prudent) evaluates on several dimensions. Two such dimensions discussed are seriousness (the term "dread" is used) and familiarity (the term "unknown" is used). Comparison of risk management in Britain and the U.S. shows also the effect of different values. Uncertainties in interpreting evidence may be value-laden but not recognized--examples in medicine, actions of the EPA, and nuclear waste management are discussed. Ostensibly entirely scientific decisions, such as determining the benefits of a new drug, have a moral dimension because of the use of such decisions, in this case by physicians not in a position to know the uncertainties.

These value issues of different attitudes toward risk and about scientific conclusions imply that the making of policy should be based on more than simply disembodied estimates of fatalities. The next step in the argument is whether risk management, certainly based on values, can (or ought) to be separated from risk assessment, because assessment (deciding when a risk is substantial enough to be regulated) also involves values. The book shows, among much else, how philosophy and value studies can contribute to studies about risk by bringing experience dealing with probabilistic reasoning, causal inquiry, and a willingness to challenge the rationality and objectivity of science.

SCHIFFER, MICHAEL BRIAN. *THE PORTABLE RADIO IN AMERICAN LIFE*. TUCSON: UNIV. OF ARIZONA PRESS, 1991. 231 P. ILLUS. BIBLIOG. HARDCOVER: $45.00.

Contrary to the CBS program *60 Minutes*, an American company was the first to sell a portable transistor radio. Sales flourished, giving Japanese companies an opening, partly because of the appeal of rock and roll to teenagers and their elders' disdain--these radios, especially with ear plugs, offered privacy and mobility. Japanese manufacturers took over the market and eventually most of U.S. consumer electronics for several reasons: 1957 labor costs which were about one seventh of those in the U.S., domestic Japanese incentives for miniaturization and extended battery life, a wise policy decision by MITI to target that industry, distraction of U.S. electronics manufacturers by military orders, and the U.S. policy to support Japan's economic recovery. The story starts with Marconi who had tried in vain to get the government of his native Italy interested in wireless telegraphy. In Britain, whose global empire went from "Aden to Zanzibar," he found stronger interest. Portable radios in the early 1920s were the size of suitcases and cost a month's salary for the average worker, plus recurring and steep battery expenses. Radios came from the same heritage of American invention as did the automobile and, like the automobile, moved in the twenties from the rich to the masses. The basic circuit used today, a superheterodyne, was invented as early as 1922 by Edwin Armstrong, who later invented frequency modulation--FM. Acceptance of portable radios was fostered by writings of popular visionaries--Hugo Gernsback was the most conspicuous--who made them cultural imperatives, products believed desirable and inevitable. The book is filled with pictures of radios, and the older reader will get a special pleasure at finding ones she or he recognizes. Schiffer is an archaeologist and explains that archaeologists deal with the common unglamorous items of everyday existence such as portable radios, which give a window into the changing lifeway of an ancient society. The book certainly gives much insight into how the world around us came to be. It combines gracefully technology, popular culture, and actions of multinational companies. Highly recommended.

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Science, Technology & Society is a newsletter devoted to the general area of science, technology, and society studies. It is a joint project of the Lehigh University STS Program and the Technology Studies Resource Center and publishes short articles on the theoretical and speculative aspects of curriculum development, in-depth program and course descriptions, reviews of texts and audio-visual aids, and an annotated bibliography of current books and articles. An "Open Forum" section exists for readers with questions, comments or announcements regarding STS activities or needs. Our goal is to help generate new courses, and provide an information exchange, in the STS field. Subscriptions, covering six issues, are available for $8.00 per year--checks payable to Lehigh University. Back issues are available for $1.50 each.

Please address all materials for publication and correspondence to: Dr. Stephen H. Cutcliffe, Editor, STS Newsletter, Maginnes Hall, Lehigh University, 9 W. Packer Ave., Bethlehem, PA 18015

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Science, Technology & Society

Curriculum Newsletter of the Lehigh University STS Program & Technology Studies Resource Center

Editor:
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No. 91, September 1992
ISSN: 0275-8075

STS AS SOCIAL MOVEMENT:

ON THE PURPOSE OF GRADUATE PROGRAMS*

In his role as the observant outsider, Juan Ilerbaig (1992) detects "two STS subcultures" in the United States pursuing increasingly divergent paths. It is hard to disagree with his more general points, especially that the divide occurs between STS graduate programs with a problem-centered, social activist bent (e.g. Penn State) and ones with a discipline-centered, scholarly bent (e.g. UC-San Diego). This division is repeated even in what "STS" is said to stand for: "Science, Technology, and Society" or "Science and Technology Studies." Does the STSer primarily identify with the aims of the NASTS [National Association of STS] or the 4S [Society for Social Studies of Science]? There are even alternative histories told of these two strains, both starting in the 1960s, but one starting with the Vietnam War and the other with Thomas Kuhn. In my latest book (Fuller 1993), I go so far as to characterize this as a Low Church-High Church distinction, with no regrets for the invidious comparisons that it invites.

As a philosopher of science who styles himself a "social epistemologist" (Fuller 1988) and who teaches in one of the High Church outposts, I found it curious that Ilerbaig would trace the apparent academic insularity of programs such as mine to the "sociological revolution," by which he largely means the Sociology of Scientific Knowledge and its aftermath. His account suggests much more uniformity within the High Church than is in fact the case. A brief look at our internal divisions will shed some light on the crossroads that faces all of STS today, both High and Low Church. But first, I should say that I believe that the existence of two STS subcultures is unfortunate and, hopefully, only a temporary state of affairs. On the one hand, I would hate to see the Low Church's activism dissolve into minor revolts from the margins; on the other hand, I would be equally disappointed if the High Church ossified into yet another species of "normal science." To prevent either possibility from being

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* *Editor's Note*: The following essay, written by Professor Steve Fuller of Virginia Tech, was submitted in response to some of the ideas raised by Juan Ilerbaig in the June 1992 issue of this Newsletter. Professor Fuller wishes to thank Sujatha Raman (Graduate School of Public and International Affairs, University of Pittsburgh) for first suggesting to him the idea of STS as a social movement.

realized, it is essential that the two subcultures see themselves as part of a common movement, taking seriously the sociological implications of the underscored term.

Within the High Church, there is a split between those who promote STS as a new interdisciplinary field in its own right and those who identify STS as a complex area of study requiring the resources of several already existing disciplines. In institutional terms, this difference is easily seen. At one extreme, RPI has an autonomous STS Department, whose core graduate courses make reference, not to other disciplines, but rather to "theory," "method," and "policy." Not surprisingly, RPI lacks developed social science and humanities departments, and so STS does not seem to compete directly with anything in the academic structure. At the other extreme, UC-San Diego has a "Science Studies Program" which is jointly governed by the History, Philosophy, and Sociology Departments. A student must be admitted into one of these three before being admitted to Science Studies. The core courses are also divided along disciplinary lines, and students are subject to the conflicting demands imposed by the different disciplines. Given the current economic climate, a reasonable prognosis for the two programs is that RPI students will be placed in non-academic policy posts and a few interdisciplinary programs, whereas UC-San Diego's students will find themselves employed by traditional academic departments.

My own program at Virginia Tech lies somewhere in the middle, somewhat closer to the UC-San Diego pole, though my own sympathies are clearly with the RPI pole. It seems that when our program was founded, about a decade ago, "STS" was a sufficiently loose notion to encompass a variety of humanities and social science faculty who would otherwise not have access to graduate students. I think few here realized that the field would start to acquire an identity of its own, once a recognizable STS literature developed. And here it is important to realize that, from the standpoint of faculty committed to the traditional disciplinary structure of the university, the literature generated by the members of NASTS and 4S look much the same in their heterodox blending of methodologies as well as in the way they intermingle social and cognitive concerns. Whether we fancy ourselves homespun populists or new wave mandarins, the members of NASTS and 4S stand together as counterweights to the increasing specialization and disengagement of academic life. In this respect, the High and Low Church wings of STS would more easily enlist in common cause if we saw ourselves the way our opponents see us, which brings us back to STS as a social movement.

There is a vulgar way of thinking about social movements that makes them seem purely reactive entities composed of disgruntled (if not downright irrational) individuals, entities that lack the sustained purposefulness of proper institutions. Indeed, sociologists have traditionally treated movements as transient or degenerate social formations. Even today, is there a committed academic who does not wince at the thought of being part of a "movement"? However, in recent years, movements have been given a facelift, as STS research has been brought to bear on the sorts of concerns that Marx originally raised about the status of socialism in *The German Ideology*. The best of these works, Eyerman & Jamison (1991), portrays movements as flexibly organized "cognitive praxes," the direct competitors of business, government, and the academy in producing knowledge that enables (and disables) certain transformations of social life. What differentiates movements from, say, disciplines is their mode of organization, not necessarily their goals, their longevity, or their sense of inquiry. Successful movements manage to retain their dynamism as they gain credibility. They do not simply "evolve" into disciplines. However, because credibility popularly rests on the degree of stability that is contributed to the social order, the dynamic credibility required of successful movements would seem to strain the imagination. STS is in a position to relieve some of this strain.

Eyerman & Jamison point to a "European"

and an "American" way of conceptualizing social movements. Each is necessary, but not sufficient, for maintaining a movement's dynamism. Both are needed. Europeans emphasize the role of movements in forming a collective identity among people who may be disparately located, but who nevertheless share experiences which heretofore have been ignored or trivialized--even by these individuals themselves. Familiar examples of such heightened experiences, or "raised consciousness," can be found in the reinterpretations that people of color and women have given to routinized forms of discrimination. The original example that Marx used to discuss this feature of movements is particularly instructive for STSers. He referred to Luther's campaign to get the peasants to stop discounting the cognitive significance of their own sensory and spiritual experience. This campaign was at once directed against heliocentric astronomy and Catholic theology, which, in their quite different ways, were bastions of cognitive authoritarianism. However, as Marx himself already realized, a movement that thrives entirely on consciousness-raising is likely to be confined, ever more dogmatically, to just those people who have had the relevant sensitizing experiences. In short, it becomes cultish to the point of losing all hope of establishing society-wide credibility.

In contrast, American accounts focus on the more instrumental side of movements, the ability to achieve the goals on their agenda. Here we find the efforts to distill utopian aspirations to planks on a party platform, which enable the movement to make a series of short-term alliances with more mainstream interest groups. Not surprisingly, the sheer increase in the movement's dimensions is taken by its members to be a sign of progress, even if it involves diluting the movement's identity and exaggerating the significance of getting a compromise bill passed as part of an omnibus legislative package. The advantage of seeing movements as agenda-pushing vehicles is that it provides concrete reference points for the movement's activities, continually reminding the movement's members--especially those who have not had the relevant sensitizing experiences--that it is heading the entire society in the right direction. However, a movement that is exclusively focused in this way easily falls victim to its own success, as the movement's ability to adapt to the mainstream gets mistaken for its ability to bend the mainstream to its will. In that sense, instrumentally-oriented movements wither by virtue of becoming a little too credible.

The dynamic credibility of STS as a movement depends on our steering a creative path between cultishness and co-optation. This means that we must cultivate a distinctive form of consciousness, while aiming for particular concrete goals. I believe that the development of a new interdisciplinary field of Science and Technology Studies, on roughly the RPI model, is probably the best vehicle currently available for fostering a dynamic sense of credibility. Such a strategy capitalizes on STS's natural powerbase, the university, which by itself already accords some measure of credibility to the knowledge produced by STSers. However, this credibility can be maintained and enhanced only in certain ways, which I will briefly elaborate.

First, it is important that we do not unduly minimize our own status as academics. In principle, it sounds fine to decry technoscientific elitism and to appeal "directly" to the pressing social problems of the day, divested of the esoteric trappings of academic discourse. Unfortunately, this is not a rhetorical strategy uniquely our own, given the avowedly democratic society in which we live. For every STS populist who thinks that some digestible bit of chemistry or biology will enlighten students as to the scope of our current environmental problems, there is someone ready to mobilize other facts--often from the same disciplines and with more homespun charm--to quite opposite ends. In fact, I often wonder whether we only continue to alienate our students from the larger society, if they come to understand the science behind social problems but are not

provided with the political means to use this newfound knowledge to empower themselves and others. How many science and engineering majors do you know who, after getting their consciousnesses raised, simply slip into the margins, lowering their ambitions or dropping out of science entirely? I worry that the net effect of STS populism is merely a contribution to social entropy. For this reason, we need to use our status as academic knowledge producers to create forums in which STS perspectives can become politically engaged.

I believe that the most empowering weapon in the STS rhetorical arsenal is the cornerstone of the "sociological revolution" that Ilerbaig criticizes so much, namely, ethnographic distance (see especially Latour & Woolgar 1979). I am not talking here about ethnography in the usual High Church way, as a total methodology for studying science. Rather, I am talking about the elementary insights that give this method the power it has, namely, that you do not need to be an expert to understand expertise, and, moreover, that the experts themselves may not live up to their own standards. In a sense, all you need to do is to go to the experts' workplaces and compare what they say with what they do. As with other claims about the potential mismatch between "words" and "deeds," many different spins can be given on how to interpret these maxims. Nevertheless, ethnographic distance is especially pertinent in our own times, as we all grow less knowledgeable of all there is to know. Indeed, the colonization of knowledge by expertise is now such a mundane feature of our existence that it has even become a common measure of social progress, in the guise of "increased specialization." However, STS research shows that, while scientists and technologists are certainly doing things differently (and more expensively) than they used to, it remains to be seen whether these things have the significance attributed to them by both the practitioners and the public.

In particular, STS researchers tend to draw a sharp distinction between the processes by which artifacts are produced in technoscientific workplaces and the circulation of those artifacts in the society at large. The very drawing of such a distinction is already subversive, as the power of science and technology has been traditionally expressed in such circulatory terms as "application," "replication," "transmission," "transfer,""utilization,""publication,""distribution," "reception," and even "education" itself--all of which have come under intense empirical scrutiny by STS researchers. Sometimes this research is misunderstood as concluding that science and technology exert no power at all, and that the circulatory terms have no referents. The correct understanding is that science and technology have no intrinsic powers, but require the active engagement of many people and things, most of which are left out of the standard technoscientific stories, but which, if included, would highlight the politics of the situation.

The skepticism that accompanies any exercise of ethnographic distancing typically upsets colleagues in other disciplines who feel that their own powerbases might soon be eroded. The challenge for us is to find public forums for turning such informed skepticism to good effect. One quite specific but important goal would be for recognized STS researchers to regularly testify before Congressional committees on the significance of a scientific project for research, applications, education, the economy, and the culture more generally. On such matters, Congress is prone to take testimony only from people credentialed to pass judgement on the technical feasibility of the project, yet the judgments that these experts are called to make easily wander to issues that an STSer is better equipped to handle. Because there is no formal cross-examination of the experts' testimony, the standards of evaluation remain abysmally low. Often it seems that billions of dollars are spent on the basis of arguments about the larger significance of a "megaproject" that could easily be

refuted by an undergraduate with a couple of STS courses under her belt.

At a deeper level, STS intervention may even serve to empower our elected representatives. For included in the implicit "political correctness" code by which Congress deals with scientists is a principled commitment to support all technically competent research; barring any obvious threats to the lives of the voters, only the sheer lack of funds should ever be able to kill a science proposal. Over time, STS may teach Congress to rescind this commitment, and to be bolder in its interrogation and evaluation of scientific research, as the experts may not be the best judge of the significance of their own projects.

Finally, in defense of a distinctive academic powerbase for STS the movement, a critical comment is in order as to how one ought to design a curriculum for this field. Ilerbaig seems to be captivated by the Low Church's willingness to incorporate such eminent, readable, and, in many cases, admirable sources as Mumford, Ellul, Toffler, Galbraith, and Winner. By contrast, the High Church curriculum is insulated with sociologists who are known only to other social scientists. On the surface, the former list of authors would seem better suited for sustaining a social movement, were it not for the inconvenient fact that the works of these authors were written pretty independently of one another. Thus, such a list forms more an inspirational set of "Great Books" than a continuous tradition of social criticism.

This is no small point when considering how to convey to students the idea of STS as a social movement, which at the very least must involve specifying a project that is common to the texts under study, not merely at a certain pedagogical level of abstraction, but in the texts themselves. To show that STS exists as a movement, it is not enough to show intellectual affinities, for that is the stuff of which "utopian" thought (in Marx's pejorative sense) is made. One needs to provide vibrant models of collective knowledge production. The "sociological revolution" has already given us that. Our task is now to insinuate that swirl of discourse into the pressing social problems of our times, just as the most successful movements in the modern era have (cf. Wuthnow 1989).

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REFERENCES

Eyerman, Ron and Jamison, Andrew (1991). *Social Movements: A Cognitive Approach*. University Park PA: Penn State Press.

Fuller, Steve (1988). *Social Epistemology*. Bloomington IN: Indiana University Press.

Fuller, Steve (1993). *Philosophy, Rhetoric, and the End of Knowledge: The Coming of Science and Technology Studies*. Madison WI: University of Wisconsin Press.

Ilerbaig, Juan (1992). "The Two STS Subcultures and the Sociological Revolution," *Science, Technology & Society* 90 (June): 1-6.

Latour, Bruno and Woolgar, Steve (1979). *Laboratory Life: The Social Construction of Scientific Fact*. Beverly Hills CA: Sage.

Wuthnow, Robert (1989). *Communities of Discourse*. Cambridge MA: Harvard University Press.

THE DEVELOPMENT OF SCIENCE, TECHNOLOGY AND SOCIETY

AT TSINGHUA UNIVERSITY, BEIJING, CHINA

The rapid development of modern science and technology, especially the development of high-technology, plays an increasingly important role in both production and cultural life, indeed, in all ways of human life. In the early 1980s we realized that the tide of a new high-technology revolution was rushing in with tremendous force, a force that would have significant influences on all aspects of social life in China. This enhanced attention to the interactions of science, technology, and society led us to look into the development of the STS field in the United States. We conducted a research project whose final report, *Programs in Science, Technology and Society* (STS) *in the United States* drew the following set of conclusions.

The STS field is transdisciplinary. As such it deals with both the natural and the social sciences, and in particular with the interactions between science, technology, and society. STS has become not only the focus of a new academic field, but also a difficult problem that often puzzles the departments of government. As a new branch of learning, STS has become a major at many universities in the United States, and many others have set up formal STS programs. In fact, STS has frequently been added to the list of traditional disciplinary majors of mathematics, physics, chemistry, astronomy, geography, biology, and the newer fields of computer science, environment, space, and materials. However, STS is more interdisciplinary, tending as it does to bring together the natural and social sciences. Interestingly the U.S. weekly *Science News* has now created a category for developments in science and society, parallel to those long listed for achievements in mathematics, physics, chemistry, astronomy, geography, biology, environment science, space science, materials science, and computer science.

Following our review of the U.S. situation, including particular American programs, but in light of the specific conditions of our country, we set up the Institute of Science, Technology & Society at Tsinghua University. At present there are three Professors, six Associate Professors, and four Assistant Professors in our Institute. Of this total, three of our faculty members have been able to study in the United States. Since 1985 fifteen graduate students have been enrolled in our Institute, and eight graduate students have received the Master of Philosophy degree. Our work includes three major aspects--1) teaching, 2) academic research and publication, and 3) applied policy and economic development projects.

1. Currently we offer 15 courses in the field of STS.

Introduction to STS.
Systems Theory.
Methodology of Systems Science.
Science of Sciences and Management of Science-Technology.
Coordinative Development of Science-Technology, Economy, and Society.
Systems Engineering of STS.
High Technology and Society.
The Strategy and Policy of Science and Technology.
Sociology of Technology.
Development Strategy and Scientific Decisions.
The Theories and Methods of Regional Strategy and Planning.
Psychology of Cognition.
General History of Science and Technology.
History of Modern Science and Technology.
Philosophy of Technology.

2. We have published nine books and dozens of research papers about STS.

Books:

The Theories and Methods of Development Strategy and Regional Planning Systems.
Systems Science and Social Systems.
Artificial Intelligence and The Progress of Society.
History of Modern Science and Technology.
The Development of Modern Science and Technology and the Scientific Approaches.
The History of Computers.
Modern Sciences and Modes of Thinking.

Development Strategy and Scientific Decisions.
Psychology of Cognition.

Research Papers:

"Science and Technology Problems in the Development of the Raw and Semifinished Materials Industries in Western China."
"Science and Technology As a Powerful Motive Force in the Development of the Raw and Semifinished Materials Industries of Our Country."
"A Coordinative Development Model of Science-Technology and Economy in Beijing City."
"Development Strategy Studies with Systems Science."
"A Study of Building Up the National Engineering Research Center."
"Solving Organizational and Complicated Problems with the Theories and Methods of Systems Science."
"Comparative Studies on the Theories and Methods of Regional Planning."

3. Perhaps the major distinction between U.S. STS programs and that of Tsinghua University is that we take on numerous applied tasks created by the State Science and Technology Commission, the State Planning Commission, the State Education Commission, the National Natural Science Foundation, the National Social Science Foundation, and the Decision Departments of some provinces and cities. Basically these research tasks have been divided into three groups:

Studies on the Strategy and Policy of Science and Technology.

Study on an Evaluation Index System of Science and Technology Appropriations in our Country.

Study on the Standard Calculating Methods and the System of Science and Technology Investment in our Country.

Study on the Operational Mechanism and the Policy of Science and Technology Investment in the Whole Nation.

Study on the Ways and Possibility of Increasing Science and Technology Investment in the Whole Nation.

Study on the Role of High-Technology Industry Development Districts in the Development of the Whole Nation's Economy.

Study on the Management of Science and Technology in a City.

Science and Technology Problems in the Development of the Raw and Semifinished Materials Industries in West China.

Science and Technology as a Powerful Motive Force in the Development of the Raw and Semifinished Materials Industries of Our Country.

Playing the Chief Engine of Production of Science and Technology in the Development of the Raw and Semifinished Materials Industries.

Studies on the Theories and Methods of the Coordinative Development of Science, Technology, Economy, and Society.

We have worked out coordinative development strategies, plans, and models for science, technology, economy, and society in seven provinces and cities which has allowed us to develop a summary theoretical and methodological framework. These studies include the following:

Comparative Study of the Theories and Methods of Regional Development Strategy and Planning.

Coordinative Development S. D. (System Dynamics) Model of Science-Technology and Economy in Beijing City.

Coordinative Development S. D. Model of Economy, Energy & Environment in Harbin City.

Coordinative Development S. D. Model of Science, Technology, Economy and Society in Anshan City.

Coordinative Development S. D. Model of Science, Technology, Economy and Society in Baotou City.

Coordinative Development S. D. Model of Science, Technology, Economy and Society in Shihezi Reclamation Area in the Xinjiang Uygur Autonomous Region.

Coordinative Development Strategy, Planning and Model of Science-Technology, Education and Society in Yanbian Autonomous Prefecture.

Study of Urbanization in Yanbian Autonomous Prefecture.

Comparative Study of the Strategy and Planning for Development in Hainan Province.

Comparative Study of the Development Means for Open Coastal Cities and those of Special Economic Zones.

Because the above-listed research work has been completed in cooperation with the decision departments of local governments, the strategies and plans worked out are practical and operational. They have raised the level of decision-making in local governments, which has been much appreciated. For example, the Beijing government awarded us a Prize for Promoting Science and Technology for our research on the Coordinative Development Model of Science-Technology and Economy in Beijing, while the State Education Commission awarded us a similar prize for our research work on a Coordinative Development S. D. Model of Economy, Energy and Environment in Harbin City.

Studies on High-Tech Industrialization.

It is mainly through high-tech industrialization that science and technology can serve as the chief engine for enhanced production in China. In this area we have conducted numerous research tasks in cooperation with the State Planning Commission, the State Education Commission, and the General Office of CPPC. Among these studies are included the following:

Study of Building Up the National Engineering Research Center.

Comparative Study on the Engineering Research Centers of China and those of the United States.

The Position and Role of Colleges and Universities in the High-Tech Development District.

Study of the Management System and Mechanism of Science and Technology Industries Belonging to Colleges and Universities.

Turning the Science and Technology Achievements of Universities into Actual Productive Forces.

These studies have formed an important basis for the decisions of leading governmental bodies and have been well received. For example, the Beijing government awarded us a Prize for Philosophy, Social Science and Policy Research for the Study of Building Up the National Engineering Research Center in 1991.

From the above-mentioned, overlapping and reinforcing activities, it should be clear that STS at Tsinghua University has three main characteristics.

1. We combine STS research work with teaching. About 500 undergraduates and 900 graduates take STS courses in our University every year. In order to enrich the content and improve the quality of teaching, we incorporate our STS research into our courses. Conversely, many questions asked by students become new topics for STS research projects.

2. We believe strongly that STS studies must be suited to the specific conditions of our country, where the social system, ideology, cultural background, and development process and stage of our country are quite different from those of the United States. At present many practical problems concerning economic reform and development and opening up to the outside world urgently need to be solved. We have studied many of these problems and put forward proposals concerning policy decisions for governments at different levels. Our studies have thus had both theoretical significance and great practical value.

3. The fact that government and other non-academic users cooperate in our STS studies raises both the scientific level and the practical value of our STS achievements. We think that our STS research work should not be done only within academia. We believe we must go to the units that need our help and work together with them. Only by cooperating with the direct users can we raise the intellectual level of our STS research, while retaining a practical element to the proposals we offer.

In pursuing STS research and teaching at Tsinghua University, we are cognizant not only of the differences in STS between China and the West, but also of the need to maintain contacts with American and European STS colleagues in order to exchange ideas and materials. To that end our Institute would like to exchange ideas and appropriate materials and would welcome STS scholars to visit our University to share your experiences with us.

Wei Hongsen, Director
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GARBAGE DUMPS
AND THE CHEMISTRY AND POLITICS OF HAZARDOUS WASTE

Converse, a liberal arts college for women, has a freshman honors program that is based on instructors offering courses out of the ordinary to a limited number of students. The course whose syllabus follows sprang from the mutual interests of the instructors as well as a desire to reinforce the connectedness of learning across disciplinary boundaries.

The twelve brave freshmen who signed up for the course in September, 1991 had a variety of intended majors, including chemistry, biology, politics, education, and English. Students could receive four credits toward their general education requirements in Natural Science or Social Science, or the course could also be used for major credit in Politics but not in Chemistry.

When we envisioned *Hazardous Waste and Public Policy Making*, our primary goal was for students to understand that decisions concerning science and technology had political implications and were affected by politics, and that in order to understand the impact of these decisions they had to understand some of the scientific background of the decisions. From this interdisciplinary base we decided to focus on the problems of hazardous waste generation and disposal as a means of illustrating the interrelationship of science (particularly chemistry), technology, and politics. In addition we hoped to show the students that (1) technology helped to create some problems of hazardous waste, (2) technology also could help to solve these problems, and (3) decisions affecting technology generally required that tradeoffs of some sort had to be made.

The readings, field trips, and laboratory work were designed to help students to understand the scientific and technical aspects of hazardous wastes as well as to develop an understanding of public policy making. The readings provided the basis for some lively class discussions and gave the students a knowledge base for the field trips. The laboratory work introduced students to the scientific method, a variety of scientific instrumentations, and the "drudgery" of collecting water samples from three local streams. The field trips included visits to a variety of waste disposal sites ranging from an old-fashioned garbage dump to a state-of-the-art hazardous waste incinerator. The field trips provided a nice mix of science, technology, and politics and enabled students to begin to think more critically about questions concerning environmental hazards. Throughout the course we encouraged students to apply the scientific and technological knowledge they were gaining to public policy questions. For example, in connection with a fertilizer lab the students had to prepare a response to a case study involving the proposed location of a fertilizer plant in a community.

In sum, *Hazardous Waste and Public Policy Making* demonstrates, as do most other STS courses, that STS is often best approached from an interdisciplinary perspective, whether explicitly as we did, or implicitly. The mix of science, technology, and politics was a good one in this case. Humanities students learned that scientific literacy is an important aspect of their lives, while science majors came to appreciate that science is not something isolated in the laboratory. All the students learned that the questions surrounding hazardous wastes are not easy to solve and will not go away. They also learned that political and scientific awareness are *equally* important in coping with these issues.

Jerry J. Howe, Charles A. Dana Professor of Chemistry
John M. Theilmann, Associate Professor of History and Politics,
Converse College, Spartanburg, South Carolina

COURSE SYLLABUS

HAZARDOUS WASTE AND PUBLIC POLICY MAKING

Fall 1991
Chemistry/Politics 199

Jerry Howe, Chemistry
John Theilmann, History & Politics

Introduction:

This is an interdisciplinary course designed to show students the connections among science, technology, and public policy-making in the United States. We will focus on questions concerning hazardous waste generation (particularly the chemistry involved) in examining these relationships.

Objectives:

1. Students will gain awareness of the role of science and technology in society, specifically in the area of the generation and treatment of hazardous waste (i.e. what hazardous waste is).

2. Students will gain an awareness of how public policies regarding hazardous wastes are made.

3. Students will gain an awareness of some of the technical issues surrounding selected hazardous wastes.

4. Students will gain an awareness of the concepts of risk and risk assessment.

5. Students will develop the ability to think critically about the interrelationship of science, technology, and politics as seen in issues relating to nuclear power and hazardous waste generation.

Textbooks:

Edward Wenk, Jr., *Tradeoffs* (Baltimore, Md.: Johns Hopkins Univ. Press, 1989).
Joseph G. Morone and Edward J. Woodhouse, *The Demise of Nuclear Energy* (New Haven, Conn.: Yale Univ. Press, 1989).
Elyse M. Rogers, *Life Is In The Balance* (Dow Chemical Co., n.d.).

Library Reserve:

ChemCom: Chemistry in the Community (Dubuque, Ia.: Kendall/Hunt, 1988).
H. W. Lewis, *Technological Risk* (New York, N.Y.: W.W. Norton, 1990).
Paul Portney, ed., *Public Policies for Environmental Protection*. Resources for the Future. (Baltimore, Md.: Johns Hopkins Univ. Press, 1990).
Bob Hall, "The Green Scorecard," *Southern Exposure* 18 (Spring 1990): 49-52.
William L. Rathje, "Rubbish," *The Atlantic* (December 1989): 99-109.

Grading Information:

The instructors may change assignments if necessary. Regular class attendance and participation in class discussion are expected. Grades for the course will be based on:

Exams I and II (100 points each)	200	Computer Simulation	20
Final Exam	150	Stream Sampling	30
Class Participation	50	7 Laboratories	
Journal	20	and/or Field Trips	105
		Total	575 points

COURSE OUTLINE

Date	Topic and Readings
Sept. 10	**Introduction: Science, Technology, and Politics.**
Sept. 12	The relationship of science and technology in a democratic society. How do scientists measure?
	Readings: Wenk, Chapters 1 and 2.
	Lab (Sept. 12): Measurement and hazard.
Sept. 17	**Public Policy Making.**
	The role of government in making public policy, i.e. the relationship of the three branches of government.
	Readings: Wenk, Chapters 3 and 5.
Sept. 19	**Hazardous Waste as a By-Product of Technological Growth.**
	The impact of technological growth on American society.
	Readings: Hall, "The Green Scorecard."
	Lab (Sept. 19): Stream Sampling.
Sept. 24	**Interest Groups and Public Policy Making.**
	Government and the impact that interest groups have on public policy-making.
	Readings: Wenk, Chapters 5 and 6.
	Field Trip (Sept. 26): Land Fills.
Oct. 1	**NASA Visiting Scientist.**
	Technology planning and the control of environmental hazards at NASA.
Oct. 3	Exam I.
	Lab (Oct. 3): Stream Sampling.
Oct. 8	**Risk and Waste Management--Chemical Waste.**
Oct. 10	What are the hazards posed by chemicals in the environment? What is the impact of five common chemicals on society and the environment?
	Readings: Lewis, Chapters 11 and 12; ChemCom, pp. 471-74.
	Lab (Oct. 10): Fertilizer Chemistry.

Oct. 17 **Technology and Risk.**
Some definitions of risk as applied to technological hazards. Public perceptions of technological risks.
Readings: Wenk, Chapter 4; Portney, Chapter 5.
Field Trip (Oct. 19): Sewage Treatment Plant and Incinerator Site.

Oct. 22 **Risk Assessment.**
How technological risks are measured. Risk policy: the scientists' and the public's views.
Readings: Rogers; Lewis, Chapters 3 and 5-8.

Oct. 24 **Solid Waste.**
How can we deal with the solid waste generated by American society?
Readings: Rathje, "Rubbish."
Lab (Oct. 24): Stream Sampling.

Oct. 29 **Air and Water Pollution.**
Oct. 31 What are the hazards posed by chemicals emitted into the air and water? How can these hazards be dealt with?
Field Trip (Oct. 31): Attend a Department of Health and Environmental Control Hearing.

Nov. 5 Exam II

Nov. 7 **Nuclear Power and Technological Risk.**
Background: the development of the U.S. nuclear power industry. What are the potential pluses and hazards of using nuclear power?
Readings: Morone & Woodhouse, Chapters 1-4, Appendix.

Nov. 12 **Nuclear Power Decision Making.**
Nov. 14 What decisions were made concerning the development of the U.S. nuclear industry? How were these decisions made?
Readings: Morone and Woodhouse, Chapters 5 and 6.
Field Trip (Nov. 14): Oconee Nuclear Plant.

Nov. 19 **Nuclear Waste and the Future of the U.S. Nuclear Industry.**

Nov. 21 **Scientific Data Analysis and Presentation.**
How does the scientist analyze and present data?
Lab (Nov. 21): Stream Sampling.

Nov. 26 **Technology and Democracy.**
Who should shape decisions concerning technology in a democratic society?
Readings: Morone and Woodhouse, Chapters 7 and 8.

Dec. 3 **Technological and Political Solutions.**
How is it possible to make "better" decisions concerning technology?
Readings: Wenk, Chapter 10.

Dec. 5 **You Make the Decisions.**
Air and water quality reports. Report on computerized environmental planning simulation.

OPEN FORUM

EMPLOYMENT OPPORTUNITIES

SCIENCE AND TECHNOLOGY STUDIES
RENSSELAER POLYTECHNIC INSTITUTE

Department of Science and Technology Studies expects, subject to budgetary approval, to have two tenure-track openings: either both Assistant or one Assistant, one Associate Professor. Completed Ph.D. preferred. The ideal candidates should have research interests in environment and/or energy or in manufacturing and/or design and some combination of the following: a government and public policy, politics, political theory or ethics orientation; interest in industrial policy and organization; a multicultural, comparative, global, or South perspective; a focus on race (particularly African-American issues), class and ethnicity; or the ability to teach empirical research methods. The department has a full range of STS degree programs from B.S. to Ph.D. and responsibility for undergraduate disciplinary courses. It has 18 faculty from 6 disciplines in the humanities and social sciences and offers an interdisciplinary research community, salary, and other support that reflects institutional commitment to leadership in this rapidly developing field. Send c.v., the names of three references, and one example of work to Shirley Gorenstein, Chair, STS, Rensselaer Polytechnic Institute, Troy, NY 12180-3590. Screening will begin November 1, 1992, and will continue until the positions are filled. Applications received after November 1, 1992 cannot be guaranteed full consideration. Starting date is September 1993. Rensselaer is an equal opportunity/affirmative action employer.

VISITING PROFESSORSHIP
SCIENCE, TECHNOLOGY AND SOCIETY
CARLETON COLLEGE

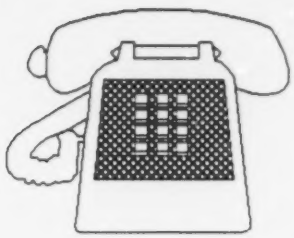
Carleton College invites applications for one-term visiting appointments to the Winifred and Atherton Bean Chair in Science, Technology and Society during 1993-94 and 1994-95. The Bean Chair supports the curriculum of the Technology and Policy Studies (TAPS) Program, an interdisciplinary concentration focusing on public policy issues related to science and technology. Students in the program are drawn from the natural and social sciences and humanities.

Candidates should have a distinguished record of teaching and scholarship in some area of science and technology studies. They may come from any discipline, including engineering, but preference will be given to applicants with broad experience and background. Appointments are normally made for one ten-week term (fall, winter, or spring), but consideration may be given to other arrangements. The teaching load is one course and one upper-level seminar. Salary is negotiable. Applications for the 1993-94 academic year must be received by January 1, 1993. A letter of interest, curriculum vita, and list of at least three references should be mailed to Dr. Norman J. Vig, Political Science Department, Carleton College, Northfield, MN 55057. Women and minority candidates are especially encouraged to apply. Carleton College is an equal opportunity employer.

CULTURE, SCIENCE, AND TECHNOLOGY PROGRAM
UNIVERSITY OF ARIZONA

The Univ. of Arizona announces a tenure track position in the Cultural, Social, and Behavioral Contexts of Engineering and Technology. Appointment is in the College of Engineering with joint or adjunct position in Social or Behavioral Sciences as appropriate (i.e., sociology, anthropology, history, etc.). Ph.D. required. Send c.v., publications list, summary of research interests, and names of three references to Search Committee, c/o Professor D. R. Uhlman, University of Arizona, Tucson, AZ 85721. Closing date for applications is December 15, 1992. Applications from women and minority candidates are encouraged. The University is an Equal Opportunity/Affirmative Action employer.

RESEARCH SUPPORT

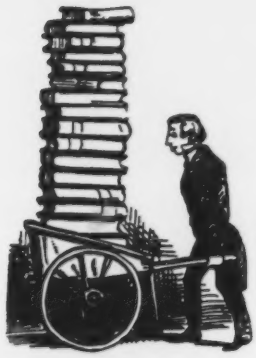


NATIONAL SCIENCE FOUNDATION
STUDIES IN SCIENCE, TECHNOLOGY AND SOCIETY PROGRAM

The Studies in Science, Technology and Society Program of the National Science Foundation and its Ethics and Values Studies component announce the availability of grants for research examining the intellectual and value contexts that govern the development and use of science and technology. NSF encourages examination of the ethical, value, or policy aspects of the interaction between science, technology, and society. Along with grants for extraordinary expenses of dissertation research and support for instrumentation, support for projects in three areas is available: 1) SSTS and EVS Scholars Awards, which support individual researchers; 2) grants for collaborative research, infrastructure or education projects; and 3) Professional Development Fellowships for researchers who wish to improve their skills in the ares of SSTS and EVS or in areas of science or engineering. The next deadline is February 1, 1993. Applicants should obtain the SSTS-EVS Program Announcement (NSF91-109) from: Forms and Publications Unit, Room 232, NSF, 1800 G St. NW, Washington, D.C. 20550; [202] 357-3619. For further information, contact Rachelle Hollander or Ronald J. Overmann, SSTS, Room 320; [202] 357-9894.

GRANTS FOR TRAVEL AND RESEARCH
AT THE ROCKEFELLER ARCHIVE CENTER

The Rockefeller Archive Center, a division of The Rockefeller University, invites applications for its program of Grants for Travel and Research at the Rockefeller Archive Center for 1993. The competitive program makes grants of up to $1,500 to researchers in any discipline, usually graduate students or post-doctoral scholars, who are engaged in research that requires use of the collections at the Center, which include the records of the Rockefeller family, the Rockefeller Foundation, the Rockefeller University, and other philanthropic organizations and associated individuals. The deadline for applications is December 31, 1992; grant recipients will be announced in March. Inquiries about the program and requests for applications should be addressed to Darwin H. Stapleton, Director, Rockefeller Archive Center, 15 Dayton Avenue, North Tarrytown, New York 10591-1598.



GRADUATE EDUCATION

GRADUATE STUDY IN THE HISTORY OF TECHNOLOGY
LEHIGH UNIVERSITY

Lehigh University invites applications for graduate study leading to the M.A. and Ph.D. degrees in history. Lehigh has faculty who specialize in a wide range of areas including American technology, early American crafts and industry, business history, urban and building technology, Japanese industrialization, STS, history and philosophy of science, and science and technology policy. The graduate program in the history of technology is closely linked with Lehigh's Science, Technology and Society Program and the Building and Architectural Technology Institute. The library holdings are exceptionally strong in 19th century engineering, mining and metallurgy, and building construction and are complemented by the Honeyman Collection of rare books in the history of science.

Lehigh offers graduate assistantships which include a tuition waiver and stipend. To be considered for financial aid, applications must be received by February 1, 1993. For more information or an application, write to Chair, History Department, Maginnes Hall #9, Lehigh University, 9 West Packer Ave., Bethlehem, PA 18015; [215] 758-3360.

THE SCHOOL OF HISTORY, TECHNOLOGY, AND SOCIETY
GEORGIA INSTITUTE OF TECHNOLOGY

Georgia Tech announces the establishment of M.S. and Ph.D. programs in the History of Technology, effective the beginning of the Fall Quarter 1992. The Masters program consists of foundation courses in history, sociology, and policy studies, as well as more specialized reading and research seminars. The emphasis is on developing a strong general background in American and European history with special attention to the history of technology. Doctoral students normally will enroll for a third year of course work in preparation for comprehensive examinations at the end of that year. A distinguished faculty offers opportunities for pursuing work in a variety of areas.

For additional information, contact Department Head August W. Giebelhaus, School of History, Technology, and Society, Georgia Institute of Technology, Atlanta, GA 30332-0345; telephone: [404] 894-6828; FAX: [404] 853-0535.

FORTHCOMING MEETINGS AND CONFERENCES

November 6, 1992. *Technologies of Vision*, Stanford University. A Graduate Student Conference sponsored by the Depts. of Comparative Literature, French and Italian, and the Program of History of Science. Contact: Techno/Vision Conference, Dept. of Comparative Literature, Bldg. 240, Stanford Univ., Stanford, CA 94305-2087; Phone: [415] 856-0948 or 550-7130.

December 26-30, 1992. *History of Science Society Annual Meeting*, Washington, D.C. In conjunction with the American Historical Association. Contact: Executive Secretary, HSS, 35 Dean St., Worcester, MA 01609.

January 3-8, 1993. *Science Education in Developing Countries: From Theory to Practice.* Jerusalem, Israel. Contact: Avi Hofstein, Dept. of Science Teaching, The Weizmann Institute of Science, Rehovot 76100, Israel; Phone: 972-8-342278; FAX: 972-8-344115; Email: NTHOFSTN@WEIZMANN.

January 15-17, 1993. *National Association for Science, Technology and Society*. 8th National Meeting, Crystal City, Washington, D.C. Contact: NASTS, 133 Willard Bldg., Pennsylvania State Univ., University Park, PA 16802. Phone: [814] 865-9951.

February 12-14, 1993. *Inner Space, Outer Space: Humanities, Technology, and the Postmodern World*. Univ. of Alabama, Huntsville, AL. The Southern Humanities Council 46th Annual Meeting. Paper and Session Proposals (250 words) due by November 15, 1992. Contact: Daniel Schenker, Dept. of English, Univ. of Alabama, Huntsville, AL 35899. FAX: [205] 895-6949.

February 25-27, 1993. *Transmission of Science: Cultural Exchange in the Premodern World*. Univ. of Oklahoma, Norman, OK. 19 invited speakers will present sessions on the institutional, cultural, and philosophical implications of transmission at this symposium sponsored by the Dept. of the History of Science. Contact: Steven J. Livesey or F. Jamil Ragep, History of Science, Univ. of Oklahoma, 601 Elm, Room 622, Norman, OK 73019. Phone: [405] 325-2213; FAX: [405] 325-2363; Email: aa9214@uokmvsa.bitnet.

April 5-7, 1993. *Resistance to New Technology, Past and Present*. Science Museum, London. Historical and sociological comparison of patterns of public response to post-war technology, especially nuclear power, information technology, and biotechnology. Contact: Martin Bauer, Science Museum Library, London SW7 5NH, U.K. Phone: [071] 938-8241; FAX: [071] 938-8213.

May 21-23, 1993. *VII Biennial Congress of the Society for Philosophy of Technology*, Valencia, Spain. Special theme, "Technology and Ecology," but sessions on other topics are also included. Contact: Larry Hickman, Dept. of Philosophy, Texas A&M Univ., College Station, TX 77843-4237.

July 14-18, 1993. *Sixth Biennial Meeting of the International Society for the History, Philosophy and Social Studies of Biology*. Brandeis Univ., Boston. Session, workshop, poster and roundtable discussion proposals due by Dec. 1, 1992. Contact: Patricia Williams, IS/HPSSB Program Chair, P. O. Box 69, Covesville, VA 22931; E-mail: PW9H@VIRGINIA.EDU. For local arrangements, contact: Michael Lynch, Sociology Dept., Boston Univ., 96-100 Cummington St., Boston, MA 02215. Email: SOC8ARN@BUACCA.

September 8-11, 1993. *Technological Change*, Rhodes House, University of Oxford, England. Co-sponsored by the British Society for the History of Science. Contact: Robert Fox, Modern History Faculty, Broad St., Oxford OX1 3BD, England. FAX: 086-525-0704.

October 14-17, 1993. *Society for the History of Technology Annual Meeting*, National Air and Space Museum, Washington, D.C. 3 copies of paper and panel proposals, including 150-200 word summaries and vitae for each presenter, should be submitted by Feb. 1, 1993, to Philip Scranton, Center for History of Business, Technology and Society, Hagley Museum and Library, P. O. Box 3630, Wilmington, DE 19807; Phone: [302] 658-2400.

November 19-22, 1993. *Society for the Social Studies of Science Annual Meeting*. Purdue Univ., W. Lafayette, IN. Paper and panel proposals with 150 words abstract due by March 1, 1993. Contact: Linda Layne, STS Dept., Rensselaer Polytechnic Institute, Troy, NY 12180. Email: usergefv@rpitsmts.

BOOK REVIEW

Susan E. Cozzens and Thomas F. Gieryn, eds. *Theories of Science in Society*. Bloomington and Indianapolis: Indiana Univ. Press, 1990. 264 P. Hardcover: $20.00.

This collection of essays is aimed at sociologists of science, sociologists of a more general outlook, and more broadly to those concerned with the interdisciplinary world of STS, especially as it relates to science and technology in policy-making settings. As the title attests, a common theme of the included essays is the understanding of science *in* the societal context, rather than viewing scientific activity as something separate and distinct from humankind's social roles and functions.

An examination of the titles of the individual essays is perhaps most illustrative of the subject matter specifically addressed: "A Social Worlds Research Adventure: The Case of Reproductive Science," by Adele E. Clark, examines how the author's use of a sociological approach--viz. social worlds theory--configured the conduct of her own research on the emergence of reproductive science in pre-WWII America. In "Structuration Theory, Constructivism, and Scientific Change," Rob Hagendijk examines the continuity of scientific institutions over time and the resultant influence they wield upon scientific research. Thomas Gieryn and Anne Figert explore the relationship between science, the press, and government as evidenced in the *Challenger* disaster in "Ingredients for a Theory of Science: O-Rings, Ice Water, C-Clamps, Richard Feynman, and The Press." Donald Fisher's "Boundary Work and Science: The Relation Between Power and Knowledge" looks at definitions of science and 'non-science' to reveal how knowledge is controlled and power is thereby held and exerted. "The Social Roots of Pure Mathematics," by Sal Restivo takes issue with the notion of "pure" science and whether or not such a phenomenon really exists. Daryl Chubin addresses scientific codes of behavior in "Scientific Malpractice and the Contemporary Politics of Knowledge," while Susan Cozzens's "Autonomy and Power in Science" explores whether or not science is ever an insular endeavor. In "Forms of Patronage" Steven Turner hypothesizes that forms of support for science outlast the political forms under which they were begun and speaks of some of the ramifications that holds for the social structure of science. Lastly, policy aspects are most directly addressed in terms of fostering the most conducive environments for science and technology by both Ron Westrum's "Environments for Innovation: Calculation and Generative Rationality in Technology" and "Organizational Constructs and the Assembly of Technological Knowledge," by Wesley Shrum and Joan Morris.

While the book, as a collection, is not designed primarily for undergraduate use, the essays do bring to light some of the most current arguments in the social construction of science and technology.

-- Gregory Kunkle
Department of History
Lehigh University

Readings That Help

This section of the STS Newsletter is meant to guide the reader to books or articles that someone recommended to me because they are useful, provocative, or enjoyable--at best, all three. Suggestions of other materials to be reviewed would be most welcome, with or without comments. But I hope you will feel free to comment on my opinions as well.

Barrett Hazeltine
Associate Dean of Engineering
Brown University, Providence, RI 02912

CHEEK, DENNIS W. *THINKING CONSTRUCTIVELY ABOUT SCIENCE, TECHNOLOGY, AND SOCIETY EDUCATION.* ALBANY, N.Y.: SUNY PRESS, 1992. 288 P. BIBLIOG. PAPERBACK: $14.95.

A model for STS curriculum development for K-12 schools is the final chapter. Preceding chapters build toward that model: they are concerned with science and technology education in the US, STS education worldwide, and various issues in curricula planning, focused on K-12, including constructivism and moral education. Analogies are made to other recent educational movements, including environmental education. The model makes use of Theoretical Considerations, e.g., general cognitive psychology; Data Collection Considerations, e.g. children's views about pertinent scientific studies; Content Considerations, e.g. minimum knowledge required for technological literacy; and Delivery System Considerations, e.g. pupil readiness/motivation. The range of material brought together and integrated is impressive. That and the bibliography of over 700 items should make the book indispensable to those interested in K-12 STS education.

PILLER, CHARLES. *THE FAIL-SAFE SOCIETY: COMMUNITY DEFIANCE AND THE END OF AMERICAN TECHNOLOGICAL OPTIMISM.* NEW YORK, N.Y.: BASIC BOOKS, 1991. 240 P. PAPERBACK: $20.00.

NIMBY means "Not In My Back Yard," NIABY means "Not In Any Back Yard," and NOPE means "Not On Planet Earth." The narrative describes how citizen groups successfully fought the Rocky Flats Nuclear Plant, the field testing of genetically engineered microorganisms, and the transfer into a residential area of some University of California biological research labs. A major theme is how technological decisions should be made--the former process described as "decide, announce, defend" seems no longer acceptable. A secondary theme is the decline in the public estimation of science and technology--it is hard to remember attitudes in 1957 when 90% of a polling sample "could not name a single negative consequence of science." One position on scientific decision making, probably the one taken by many technically trained people, is that only those with relevant expertise should decide. John Kemeny is quoted as saying, "Jeffersonian democracy cannot work in the year 1980, the world has become too complex." Experts, the author notes and the public seems to realize, are not always dispassionate or sensitive to political issues. Scientists work from a combination of "noble"--humanitarian--and "Nobel"--quest for prestige and grants--motives and seldom are they themselves affected directly by misjudgments. Some suggestions are given about mechanisms for public participation in technological decisions. The author's journalistic background is evident in the clarity and force of the writing.

POSTMAN, NEIL. *TECHNOPOLY: THE SURRENDER OF CULTURE TO TECHNOLOGY.* NEW YORK, N.Y.: KNOPF, 1992. 222 P. BIBLIOG. PAPERBACK: $20.50.

Technopoly "consists in the deification of technology, which means that the culture seeks its authorization in technology, finds its satisfactions in technology, and takes its orders from technology." It is "a culture whose available theories do not offer guidance about what is acceptable information in the moral domain." A central theme of the book is that the ascendance of technology has destroyed, or at least severely damaged, beliefs, including religious beliefs, central to peoples' lives. A purpose of the book is to assist people to distance themselves from a technologically driven world, understand it and change it. An example of how technology has reduced shared convictions is the trivialization of core symbols through over-exposure--television, advertising, political speeches and much more. So much reaches the citizen that nothing is noted; communications technology has made the noise level too high for national leaders to get their message through. Other examples used are more familiar: overuse of medical technology, mistrust of the validity of intelligence tests, vacuity of social science research, narrowing of inquiry to meet technological requirements, as in multiple choice tests. I would have found the overall argument more compelling if fuller attention had been given to why pernicious technology became such a powerful force. The book is distinguished from others like it by its wit and clarity of expression.

M*E*T*A*

Mankind, Ethics, Technology and the Arts

Recent Publications

FERGUSON, EUGENE S. *ENGINEERING AND THE MIND'S EYE*. CAMBRIDGE, MASS.: MIT PRESS, 1992. XIV, 241 P. ILLUS. HARDCOVER: $24.95.

This is an important book, important both for students and scholars of STS who seek a more informed understanding of the dynamics of engineering design and for practicing engineers and engineering educators whose professional self-understanding will be enhanced by reading this masterful analysis. In an extension of his seminal 1977 *Science* essay on "Nonverbal Thought in Technology," Ferguson takes the reader on a brief but extremely instructive form of "The Mind's Eye." The mind's eye is the visual way by which engineers think intuitively and nonverbally about the process of technical design. Ferguson employs numerous historical examples from the drawings of Leonardo daVinci and the illustrated machine books of Agostino Ramelli and Agricola's *De Re Metallica* through Newcomen's development of the steam engine to more contemporary problems, including the collapse of the Hartford Coliseum and the problematic operation of the Hubble space telescope, to illustrate how engineering has evolved from an intuitive, hands on, design-oriented profession to one dominated by mathematical computatation. It is his contention that contemporary engineering education's focus on "academic" analytical techniques and models is increasingly divorced from the technical realities of the human world with the potential result of increased calamitous design errors. Engineering design for Ferguson cannot be completely reduced to engineering "science" or mathematics; it "will always be based more on art than on science," important even as the latter is. "Unquantifiable judgements and choices are the elements that determine the ways a design comes together. Engineering design is simply that kind of process. It always has been; it always will be" (p. 194). An insightful addition to any STSer's library from a master engineer and educator.

LEWENSTEIN, BRUCE V., ED. *WHEN SCIENCE MEETS THE PUBLIC*. WASHINGTON, D.C.: AMERICAN ASSOC. FOR THE ADVANCEMENT OF SCIENCE, 1992. XVI, 164 P. ILLUS., BIBLIOG. PAPERBACK: $18.00.

A recognition of the necessity of considering the general public's perspective has become an important concern in the field of science communication. This volume contains the proceedings of a 1991 AAAS workshop devoted to the public understanding of science. Specific content includes: "Creating the Culture of Science," by Philip Morrison; "Not Knowing, Needing to Know, and Wanting to Know," by John Ziman; "Listening to the Audience: Producer-Audience Communication," by Valerie Crane; "Beginning with the Audience," by Marcel LaFollette; "Sheep Farming After Chernobyl: A Case Study in Communicating Scientific Information," by Brian Wynne; "Evaluating the 'America Responds to AIDS' Campaign," by Kara Marchman and Janine Jason; "Effects of 'Square One TV' on Children's Problem-Solving Behavior," by Eve Hall, Shalom Fisch, and Edward Esty; "Comparative Strategies for Making the Complex Clear," by Sharon Dunwoody; "Television," by Jonathan Ward; "Girls' Clubs," by Libby Palmer; "Newspapers," by Tom Siegfried; "Museums," by Robert Sullivan; "Strategies for Enhancing Comprehension of Science," by Katherine Rowan; "The Audiences to Listen To," by Shirley Malcom; and an Appendix: "AAAS Committee on Public Understanding of Science and Technology," by Patricia Curlin.

MILLER, GORDON L. *THE HISTORY OF SCIENCE: AN ANNOTATED BIBLIOGRAPHY*. MAGILL BIBLIOGRAPHIES. PASADENA, CALIF.: SALEM PRESS, 1992. 193 P. HARDCOVER: $40.00.

A selection of some 550 of "the best and most basic works" in the history of science published primarily since 1950. The volume also contains some material on the history of medicine; however, little in the way of history of technology is directly covered, although specific works on computers and scientific instrumentation do appear. The introduction sets a historiographical context for the evolving field of the history of science from its older science-oriented "internalist" accounts to its more recent "externalist" emphasis, which includes both the positive achievements and the perils of science. Most entries are books, although some articles and book chapters are included; all are in English. The introductory section focuses on resources and reference works including dictionaries, encyclopedias, bibliographies, and journals, and it is followed by a section devoted to general surveys. Subsequent sections deal with the physical, biological, medical, and human sciences, and each is appropriately subdivided. A final section is devoted to special themes, including among others evolution, philosophy of science, sociology of science, and women and minorities in science. There is also a short mediagraphy of audiovisual materials. Each entry includes all relevant bibliographic material, although curiously no pages are given, and each is descriptively annotated in a brief paragraph. An index of all authors and a.v. and journal titles concludes the volume.

REYNOLDS, TERRY S., ED. *THE ENGINEER IN AMERICA: A HISTORICAL ANTHOLOGY FROM TECHNOLOGY AND CULTURE*. CHICAGO: UNIV. OF CHICAGO PRESS, 1991. 437 P. ILLUS., MAPS. HARDCOVER: $44.95; PAPERBACK: $17.95.

The history of American engineering in its societal context is depicted through essays originally published in *Technology and Culture*, the journal of the Society for the History of Technology, that have been brought together in this excellent anthology. The collection is divided by century into two parts, for each of which there are subdivisions devoted to an editorial overview, background, practice, and institutions. Specific contributions include: "Introduction" and "Overviews," by Terry Reynolds; "Engineers are People," by John Rae; "Turnpike Construction in Antebellum Virginia," by Robert Hunter; "Raising and Watering a City: Ellis Sylvester Chesbrough and Chicago's First Sanitation System," by Louis Cain; "Andrew A. Humphreys and the Development of Hydraulic Engineering" by Martin Reuss; "Engineers and the New South Creed: The Formation and Early Development of Georgia Tech," by James Brittain and Robert McMath, Jr.; "At the Turn of a Screw: Williams Sellers, The Franklin Institute, and a Standard American Thread," by Bruce Sinclair; "The Electrification of America: The System Builders," by Thomas Hughes; "Mirror-Image Twins: The Communities of Science and Technology in 19th Century America," by Edwin Layton; "Local History and National Culture: Notions of Engineering Professionalism in America," by Bruce Sinclair; "The Introduction of the Loading Coil: George A. Campbell and Michael I. Pupin," by James Brittain; "Charles F. Kettering and the Copper-cooled Engine," by Stuart Leslie; "The Scientific Mystique in Engineering: Highway Research at the Bureau of Public Roads, 1918-1940," by Bruce Seely; "Defining Professional Boundaries: Chemical Engineering in the Early 20th Century," by Terry Reynolds; "Academic Entrepreneurship and Engineering Education: Dugald C. Jackson and the MIT-GE Cooperative Engineering Course, 1907-1932," by W. Bernard Carlson; and "The 'Revolt of the Engineers' Reconsidered," by Peter Meiksins.

STEFFENS, HENRY. *HISTORY OF SCIENCE SYLLABUS SAMPLER*. COMMITTEE ON EDUCATION, HISTORY OF SCIENCE SOCIETY, 1992. 249 P. PAPERBACK: $10.00.

This collection of 42 sample syllabi in the history of science is organized in six major sections: general survey courses, surveys in American science, the scientific revolution, women in science, topics in the history of biology, and selected special topics. In addition, a section listing all 187 original submitters, including those whose syllabi were not fully replicated, is also appended. The syllabi generally include a brief statement on the scope and goals of the course, a list of required readings, and a topical breakdown by class period, week, or theme, including the relevant reading assignment. Some also include additional bibliography or reading lists. An editorial decision not to include sample examination questions or term paper assignments, etc., was made in order to save space for the inclusion of additional syllabi. While some potential users may wish such material had been included, for it is often the most revealing information as to an instructor's approach and educational goals, the inclusion of the names and addresses of each submitter means one could write directly to any given instructor. This is a fine syllabi collection and well worth the modest price of $10.00. Orders from Canada are $12.00--U.S. and from overseas $15.00--U.S. All orders should be prepaid with checks payable to History of Science Society-Syllabus Project. To order, write to Prof. Henry Steffens, Dept. of History, Univ. of Vermont, Wheeler House, Burlington, VT 05405.

RECENT ENVIRONMENTAL STUDIES RELEASES

CLINE, WILLIAM R. *GLOBAL WARMING: THE ECONOMIC STAKES*. POLICY ANALYSES IN INTERNATIONAL ECONOMICS 36. WASHINGTON, D.C.: INSTITUTE FOR INTERNATIONAL ECONOMICS, 1992. 103 P. BIBLIOG. PAPERBACK: $12.00.

A condensed summary of Cline's forthcoming book-length analysis entitled *The Economics of Global Warming*. Cline believes we will witness a global warming of about 10°C over the next 300 years resulting in extensive economic impacts unless the global community embarks on an aggressive path to limit the greenhouse effect. Cline proposes just such an approach, one divided into two stages, in which the first employs current, "milder," low-cost measures, with a second more intensified set of actions following a decade of additional scientific research and confirmation.

DOBSON, ANDREW, ED. *THE GREEN READER: ESSAYS TOWARD A SUSTAINABLE SOCIETY*. SAN FRANCISCO, CALIF: MERCURY HOUSE, 1991. XII, 280 P. BIBLIOG. HARDCOVER: $24.95; PAPERBACK: $11.95.

A collection of essays and article extracts that together provide a background for and the essence of the green movement which argues that fundamental alterations to the system are needed in response to environmental and social degradations. Among the better-known authors represented in the collection are Donella Meadows, E. F. Schumacher, Garrett Hardin, Murray Bookchin, Kirkpatrick Sale, Amory Lovins, Petra Kelly, Ted Trainer, Dave Foreman, Tom Regan, Aldo Leopold, Arne Ness, Rachel Carson, and James Lovelock.

DUNLAP, RILEY E. AND ANGELA G. MERTIG, EDS. *AMERICAN ENVIRONMENTALISM: THE U.S. ENVIRONMENTAL MOVEMENT, 1970-1990*. WASHINGTON, D.C.: TAYLOR & FRANCIS, 1992. XII, 123 P. PAPERBACK: $12.95.

A collection of 8 essays that focuses on the last twenty years of U.S. environmental history. Content includes: "The Evolution of the U.S. Environmental Movement from 1970 to 1990: An Overview," by Riley Dunlap and Angela G. Mertig; "Twenty Years of

Environmental Mobilization: Trends Among National Environmental Organizations," by Robert Cameron Mitchell, Angela Mertig, and Riley Dunlap; "Not in Our Backyards: The Grassroots Environmental Movement," by Nicholas Freudenberg and Carol Steinsapir; "The Quest for Environmental Equity: Mobilizing the African-American Community for Social Change," by Robert Bullard and Beverly Wright; "Deep Ecology and Radical Environmentalism," by Bill Devall; "Globalizing Environmentalism: Threshold of a New Phase in International Relations," by Lynton Caldwell; "Twenty Years of Change in the Environmental Movement: An Insider's View," by Michael McCloskey; and "Trends in Public Opinion Toward Environmental Issues: 1965-1990," by Riley Dunlap. This would make an excellent text in a variety of environmental history and studies courses.

DURNING, ALAN T. *HOW MUCH IS ENOUGH? THE CONSUMER SOCIETY AND THE FUTURE OF THE EARTH*. WORLDWATCH ENVIRONMENTAL ALERT SERIES. WASHINGTON, D.C.: WORLDWATCH INSTITUTE, 1992. 200 P. BIBLIOG. PAPERBACK: $8.95.

Durning's focus in this second volume of the new Worldwatch Environmental Alert Series is on the rampant consumerism, typified by Bloomington, Minnesota's "Mall of America," that seems to be taking over contemporary society. It is Durning's contention that, "our cars, suburbs, shopping malls, throw-away products, and meat and junk food diet add up to the most environmentally destructive way of life yet devised." In response to the titular question, "How Much Is Enough?" Durning argues the world, and especially Americans who consume their own weight in raw materials each day, must curtail consumption to a lower level of sustainable permanence and focus instead on "non-material sources of fulfillment that bring happiness: family and social relationships, meaningful work, and leisure."

HARGROVE, EUGENE C., ED. *THE ANIMAL RIGHTS/ENVIRONMENTAL ETHICS DEBATE*. ALBANY, N.Y.: STATE UNIV. OF NEW YORK PRESS, 1992. XXVIII, 273 P. PAPERBACK: $14.95.

Animal rights has become a key issue related to the field of environmental ethics. This collection of eleven essays provides a historical overview of the development of "an environmental stance on animal welfare matters as it [has] developed in the last decade," but does not include authors specifically advocating animal liberation (Peter Singer) or animal rights (Tom Regan) perspectives directly, positions elaborated and readily available elsewhere. Rather, this collection is intended to complement that literature and clarify the environmental position. A lengthy preface by editor Hargrove lays out the key positions and how the individual essays relate to each other. Specific content includes: "Self-Consciousness and the Rights of Nonhuman Animals and Nature," by Richard Watson; "Animal Liberation: A Triangular Affair," by J. Baird Callicott; "Environmental Ethics and Nonhuman Rights," by Bryan Norton; "The Ethics of Respect for Nature," by Paul Taylor; "The Significance of Species," by Mary Midgley; "Moral Considerability and Extraterrestrial Life," by J. Baird Callicott; "Foundations of Wildlife Protection Attitudes," by Eugene Hargrove; "The Rights of the Nonhuman World," by Mary Anne Warren; "The Mixed Community," by Mary Midgley; "Taking Sympathy Seriously: A Defense of Our Moral Psychology Toward Animals," by John Fisher; and "Animal Liberation and Environmental Ethics: Back Together Again," by J. Baird Callicott.

MEADOWS, DONELLA H.; DENNIS MEADOWS; AND JØRGEN RANDERS. *BEYOND THE LIMITS: CONFRONTING GLOBAL COLLAPSE, ENVISIONING A SUSTAINABLE FUTURE*. POST MILLS, VT.: CHELSEA GREEN, 1992. XIX, 300 P. TABLES, FIGURES, BIBLIOG. HARDCOVER: $19.95.

Beyond the Limits is a sequel to the path-breaking *Limitis to Growth* published twenty years ago. In their original study, Meadows, et. al, argued based on extensive computer modeling that the world faced limits to our physical growth if technological, economic, and population trends were to continue unchecked. In this follow-up analysis, Meadows and two of her original colleagues have concluded that indeed we have already "overshot" some of those limits and now the question is less "what if," and more one of "what options remain?" The authors conclude that a transition to a sustainable society is still feasible both technically and economically, but that we must begin this process of "easing down" our demands on the earth's resources soon. The study is supported with approximateldy 100 tables, figures, and possible scenarios, all of which are also available as separate slides or overheads for those who wish to incorporate the material into their classroom teaching. A softcover, 20-page executive summary is also available for anyone wishing a briefer treatment of the key issues and conclusions.

WORLDWATCH PAPERS

FRENCH, HILARY F. *AFTER THE EARTH SUMMIT: THE FUTURE OF ENVIRONMENTAL GOVERNANCE*. NO. 107, 62 P.

RYAN, JOHN C. *LIFE SUPPORT: CONSERVING BIOLOGICAL DIVERSITY*. NO. 108, 62 P.

YOUNG, JOHN E. *MINING THE EARTH*. NO. 109, 53 P.

JACOBSON, JODI L. *GENDER BIAS: ROADBLOCK TO SUSTAINABLE DEVELOPMENT*. NO. 110, 60 P.

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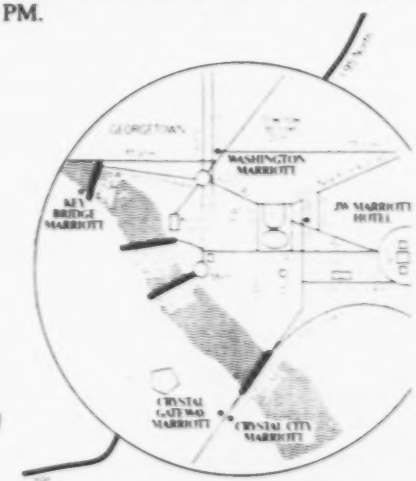

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Science, Technology & Society

Curriculum Newsletter of the Lehigh University STS Program & Technology Studies Resource Center

Editor
Stephen H. Cutcliffe

No. 92/93, November/December 1992
ISSN: 0275-8075

ON THE SOCIOLOGICAL REVOLUTION IN STS:

A FULLER ACCOUNT*

In commenting upon my paper on the two subcultures in the field of STS (cf. Ilerbaig 1992), Steve Fuller (1992) provides an interesting proposal about developing STS as a social movement. In his proposal he makes use of a distinction between a High Church and a Low Church. As he suggests, this distinction is similar to the one I offered for consideration. I think we agree on many points about what is happening among the STS community and what a good way out of the current situation would be. But I also think that Fuller has misunderstood a few of my comments. Besides, some of the features of Fuller's proposal of considering STS as a social movement should be more thoroughly discussed and more clearly expressed in order to avoid some possible dangers. I will say something about these dangers in the second part of this brief reply, after having dealt with the misinterpretations of my position that Fuller makes.

To begin with, let me clarify my general distinction between two subcultures in STS. First, I did not claim that all STS programs belonged to one of two poles. For instance, I mentioned that programs like those at Cornell University and M.I.T. (High Church programs, I guess) seemed to me more balanced (or "in the middle," to use Fuller's own words) than those at UCSD or Penn State. Secondly, I do not think that Fuller's distinction between a High Church and a Low Church in the arena of STS programs fits exactly with the one I made. His distinction is even more radical than mine, for he sharply separates the High and the Low Churches, allowing some variation within the first one. I put both subcultures along a certain continuum, pointing out that the poles or extremes were shifting away from each other. Thirdly, I did not say that what I called the "sociological revolution" was the cause of the academic insularity of certain programs. I only

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Editor's Note: This essay by Juan Ilerbaig and the following one by Steve Fuller continue and extend from the last two issues of this *Newsletter* the discussion on the status of and appropriate role(s) for STS.

said that the mentioned polarity within the STS community was related to "some features" concerning the "sociological revolution." These features are the overall lack of concern of most sociologists for evaluative approaches and the disregard that some STSers from the other side of the divide show for the analytical tools developed by sociologists of science and technology. This leads me to Fuller's misinterpretation of my comments on the "sociological revolution."

According to Fuller, the "sociological revolution" is something "that Ilerbaig criticizes so much." He suggests that my view of the High Church curriculum is that it "is insulated with sociologists who are known only to other social scientists." I seem to be "captivated by the Low Church's willingness to incorporate such eminent, readable, and, in many cases, admirable sources as Mumford, Ellul, Toffler, Galbraith, and Winner." Fuller greatly misunderstood me on this point. Some of the "admirable sources" he notes appeared in my paper in a quote of S. H. Cutcliffe, which I used to trace the origins of the field. Some others I mentioned only to point out that few professional historians, philosophers, or sociologists of science and/or technology were to be counted among the inspirational sources of the field. Finally, I made reference to Winner (somewhat mistakenly, I must admit) only in passing to show how philosophers and sociologists from different sides of the divide have launched accusations without engaging in a sustained debate.

Instead of criticizing sociology and being drawn to the other side, I criticized both sides for the lack of communication. Were I to elaborate on my likes and dislikes, I would mention that I am quite sympathetic with certain strands of the work done during the last few years in the fields of sociology of science and technology. I feel much closer to those fields than to the "admirable sources" cited earlier, and I hope that promising approaches to science and technology policy and evaluation will grow out of that sociological terrain. In my paper, I referred to a few adherents to the "sociological revolution" who had already voiced the need to supersede pure description and engage in a normative or evaluative analysis. I forgot to mention others who either have pointed out the policy implications of their work or have made contributions to normative studies of science and technology grounded in the sociological framework under discussion (for example, those of S. Fuller himself, D. Mackenzie, B. Wynne, and S. Yearley). Finally, some works conveying similar claims have recently appeared or are about to appear (Bijker forthcoming, Lynch & Fuhrman 1991, 1992, Radder 1992). I had aimed to bring attention to that territory where the goals of both sides of the divide should converge and their tools should be put to work. Fuller and I seem to agree on the need to follow this general path, but I have qualms about his specific proposal on that score.

Fuller proposes that we consider STS as a social movement. As he says, we should not minimize our role as academics. At the same time, we should seek political means to use the insights we have acquired. My reservations regarding his proposal are related to three features of STS as a social movement, namely, its institutional basis, its theoretical backbone, and its normative outcome and expression.

(i) The institutional basis.

The basis of STS as a social movement should be, Fuller maintains, "the development of a new interdisciplinary field of Science and Technology Studies." This, he claims, is probably the only way to achieve the stability that will, in its turn, provide the credibility needed by STS. I wonder how such new interdisciplinarity is to be understood. For, if we are to take seriously Fuller's own distinctions, it must be something other than the use of "the resources of several already existing disciplines." Therefore, it has to be either the use of the resources of not yet existing disciplines (presumably we will have to wait until they develop), or something that concerns no more than one discipline (and I would call such unidisciplinary interdisciplinarity a contradiction). In the past we have not managed to avoid separation between normative criticism and theoretical sophistication. Are we going to succeed by creating new disciplines, new programs, and new academic journals? I do not think that is the way we should proceed. It would be better to integrate our aims and tools with those from the other side of the divide, and test the utility of our insights in those areas where science and technology have become social problems (as Fuller nicely points out in the

last sentence of his paper). Especially since we may lose variety in standpoints in order to gain a "sense of credibility." Although our existing disciplines with their different theoretical and institutional constraints often lead to conflict and misunderstanding among their practitioners, I believe that the diversity offered by the disciplinary multiplicity in STS is valuable and should be kept.

(ii) The theoretical backbone.

Social movements, Fuller reminds us, require a continuous tradition of social criticism. The authors who gave inspiration to the field (those he labels "admirable sources") cannot provide such a tradition, he claims, since they wrote independently of one another. I agree that some of those authors do not provide enough insight into how science and technology work. Thus, there is a good reason not to build our normative constructions on them. But Fuller's reasoning lies elsewhere. For him STS as a social movement necessarily has to be built around what he calls continuity, therefore leaving apart not only inspiration but, especially, independence. If that is the case, I disagree with him. For Fuller can be taken here as defending the existence of a *doctrinaire corpus* which we all must accept before being allowed entrance in the movement. We must be very careful on this point. STS should not be reduced to sociology of science and technology. Let us engage in discussion and build up common projects, but not at the price of killing variation.

(iii) The normative outcome.

Fuller states that a specific goal of our general program to find public forums "would be for recognized STS researchers to regularly testify before Congressional committees on the significance of a scientific project for research, applications, education, the economy, and the culture more generally." If Fuller is suggesting that STS 'experts' would offer advice to legislators and social planners, then I agree completely. But, for STS researchers to acquire such a degree of recognition, a major part of the field must be directed towards ethically and socio-politically enlightening studies on specific issues. Some of Fuller's claims in the last paragraphs of his paper follow this line of thinking. Therefore, I am glad that his normative goals are now beyond the "administration of knowledge production" view, which he articulated in his *Social Epistemology* (cf. Fuller 1988, 270ff.)

As Hans Radder (1992) has recently pointed out, we can easily find "normatively relevant views" in the new sociology of science and technology. But this is something different from a "normative (systematic) reflexion." If we really want to overcome the gap between both stages, we need to use our tools in normatively oriented case studies. Until we engage in such a work, I simply hope nobody comes to our workplaces and compares what we say with what we do.

--- Juan F. Ilerbaig
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REFERENCES:

Bijker, Wiebe (1993). "Do Not Despair: There Is Life After Constructivism," *Science, Technology & Human Values* 18: 113-38.

Fuller, Steve (1988). *Social Epistemology*. Bloomington: University of Indiana Press.

Fuller, Steve (1992). "STS as Social Movement: On the Purpose of Graduate Programs," *Science, Technology & Society* 91:1-5.

Ilerbaig, Juan (1992). "The Two STS Subcultures and the Sociological Revolution," *Science, Technology & Society* 90: 1-6.

Lynch, William and Ellsworth Fuhrman (1991). "Recovering and Expanding the Normative: Marx and the New Sociology of Scientific Knowledge." *Science, Technology & Human Values* 16: 233-38.

Lynch, William and Ellsworth Fuhrman (1992). "Ethnomethodology as Technocratic Ideology: Policing Epistemic Boundaries." *Science, Technology & Human Values* 17: 234-36.

Radder, Hans (1992) "Normative Reflexions on Constructivist Approaches to Science and Technology," *Social Studies of Science* 22: 141-73.

GIVE STS A PLACE ON WHICH TO STAND, AND IT WILL MOVE THE UNIVERSITY--AND SOCIETY

While I have no specific quarrel with Ilerbaig's (1992) latest reflections on the direction that STS should take, I want to elaborate on some remarks that I made all too briefly (in Fuller 1992) about the status of STS as an interdisciplinary field and as a social movement. I have some fairly specific views about these matters that are based on disciplinary fluctuations within the university and the shifting boundary between the university and the rest of society. These are developed in my latest book (Fuller 1993), but I will offer a sampling of those views in the hope that they will encourage more people to think about the status of STS as an academic and a political entity.

Perhaps I reveal my High Church bias when I say that, in terms of immediate impact, STS (High and Low Church united) is best positioned to participate in creating the university of tomorrow. Ilerbaig and others may shudder at my original use of the expression "administering knowledge policy" as a goal of social epistemology, but it is important to be clear about why one shudders at this expression. To my mind, "administration" is problematic only if it implies an asymmetrical power relation in which a few administrators dictate what the vast majority of knowledge producers do. However, the sort of work currently done by academic administrators is one in which we should all try to be involved. It is in the context of administration that one can raise, in practical terms, the most global problems of knowledge in our society today. Consider the following questions, which increasingly arise under the rubric of university planning:

(1) why are departments so ill-equipped or uninterested in teaching courses in the general education curriculum?

(2) how does the university reconcile the trend toward larger student enrollments with other trends that point to a more rapid depreciation in the value of the training that students receive?

(3) why is it so natural to portray interdisciplinary programs as additions to the university (and hence luxury items) rather than as replacements or reconfigurations of existing programs (and hence efficiency measures)?

These three questions have become so pressing because they cut against the taken-for-granted idea that departments are "natural" academic units that somehow reflect the underlying structure of reality. Of course, it is the business of STS to show that this taken-for-granted idea (and so many others we have about knowledge) is only as true as we allow it to be.

I favor STS evolving into a field of Science and Technology Studies not because STS constitutes a new field of knowledge that deserves representation alongside the other departments of the university, but because the formal presence of STS would be a standing challenge to the very idea that departments ought to exert the sort of power they do over the life of the university. Departments, and the disciplines they represent, are conventional markers on the path of inquiry--necessary evils that become more evil the more necessary they are made to appear.

In this regard, the institutional precedents for STS are successful programs of women's studies and ethnic and regional studies. It is hard to be part of such programs without thinking that there is something wrong with how the rest of the university is divided up. At least, one is constantly forced to think about the relation between the disposition of the academy and of the society that supports its activities. Admittedly, this is not a formula for letting sleeping dogs lie, but then again, I believe that STS ought to constitute itself as a social movement--and the movement needs to begin at home. (Here it is worth recalling that the case for the university as an autonomous "public sphere" for debate was most strongly made during the "university movements" that flourished in the High Middle Ages and early nineteenth-century Germany [cf. MacInytre 1990, Shils 1992].)

Women's, ethnic, and regional studies programs are benchmarks for STS in another respect. Like the great social movements that Wuthnow (1989) documents (the Reformation, Enlightenment, and Socialism), these movements are kept alive, not by doctrinal consensus, but by intense and focused disagreement. They acquire their forward momentum from a feeling that, however sharp

their disagreements, the issues over which members disagree are serious enough to warrant continued debate--indeed, debate that is continually extended to ever larger segments of society. A good image here is that of a whirlpool that draws more attention to itself as discussion acquires more intensity. Consider an example from the Reformation: Even if I (as a Christian) believe that your formula for personal salvation is wrongheaded, nevertheless, the issue of personal salvation is serious enough to merit further contestation. Another model is provided by the Socialist and women's movements, which have been propelled by contested efforts to define a common eschatological narrative. Movements wither and die when "true believers" of various persuasions break off the debate and form sects that invite discourse only from the like-minded. (Admittedly, sectarianism is often a legitimate defensive reaction after debate has spilled over into violence.) But by the time sectarianism has set in, the movement has left its long-term mark, as the major groupings in society--most of whose members are casual observers to the movement's activities--reconfigure themselves in terms defined by the movement's discourse.

Movements are especially effective in this regard during periods of socioeconomic dislocation, when the old social categories fail to capture the emergent power relations. For however unpalatable the movement's own political agenda may be to the majority of people in society, the movement often provides the only publicly accessible framework for understanding the full range of changes being wrought in society. A good case in point is the legacy of Socialism, no small part of which was that factory owners came to think of themselves as a "class" in systemic opposition to the class represented by their employees. Of course, the factory owners did not become card-carrying socialists once they started to think of themselves as members of a class. However, by accepting this movement-inspired designation as their own, they unwittingly opened themselves to certain ways of describing and explaining existing divisions in society that made it easier to justify, say, the intervention of the state in economic affairs. Wealth that would have appeared, early in the nineteenth century, to be the result of the factory owner's individual initiative was more commonly seen, by the end of the century, as the product of some sort of exploitation. As a result of this transition, taxing owners and protecting workers became reasonable policy measures. Thus, owners have increasingly had to shoulder the burden of showing that they are entitled to keep all the wealth produced under their name.

In short, then, the discourse community created by a social movement can be politically effective simply by altering the "spin" that different groups in society give to one another's activities, which in turn opens new spaces for political realignment. Now, how does all this apply to STS?

As I pointed out in my initial response to Ilerbaig (Fuller 1992), High Church STS currently has a tradition of continuous criticism, but it is largely confined to sociologists of science and thus has yet to extend and intensify to the levels needed to produce a social movement. An apt comparison here is with the tradition of "Higher Criticism" of the *Bible* pursued by the Young Hegelian philosophers, which Marx read as symbolic of contemporary social struggles. The point of his *German Ideology* was to propel those disputes into the public forum where they might make a difference at the level of political practice (cf. Meister 1990). In the case of STS, if we agree that disciplinary designations tend to obscure more than illuminate, then we can potentially be agents for the realignment of academic labor by introducing STS issues in the course of asking both teachers and students whether their departmental or disciplinary affiliation captures their interests as inquirers. And if not, why not. A good site for these interventions would be in the so-called physics community, which has been increasingly torn between supporting "megaprojects" like the Supercollider, which benefits only a few inquirers, and supporting less glamorous but more equitably distributed forms of research.

The physics example relates to a more general point, namely, the need to identify a minimally acceptable change in society's thinking that would likely result from mobilizing the various STS discourse communities into a social movement. The change I propose is that the public and its elected representatives take science and technology to be society-wide "problems" that require the same degree of monitoring, management, and periodic restructuring as, says, the economy or any other major sector of society. In other word, the sorts of issues that are now presumed to constitute the

"internal dynamic" of science and technology--issues which are typically given the "if it ain't broke, don't fix it" policy treatment--would be subject to routine and sustained questioning. These issues include the relative patterns of funding and accounting for the various scientific disciplines, as well as the absolute magnitude of the technoscientific enterprise itself, and the associated issues of distributive justice and welfare economics that it raises: Who participates? Who benefits? Who pays? In operational terms, STSers should look to a day when politicians in their party platforms no longer treat science and technology as "factors of production," whose proper loading miraculously solves the other problems of society, but rather as problems in their own right.

This proposed change in social sensibility has the virtue of enabling all the current "doctrinal" disputes in STS to flourish, including whether the "problematic" character of science and technology is due to something deep in the technoscientific practices themselves or, rather, to the philosophical rhetoric or social significance that is attached to those practices. Indeed, it may even seem that this change in social sensibility is too minimal to be truly acceptable to those who wish to assemble themselves as a social movement. However, I would maintain that in a period when the people's taste for political participation has reached an all-time low, suddenly getting them involved in a process that they have traditionally left to benign neglect--that is, in the trusteeship of the scientific community--will be no mean feat.

An indication of the magnitude of the task ahead became clear to me this summer when I made a presentation at one of the public meetings held by the President's Council of Advisors on Science and Technology. I argued for the importance of STS to science and technology policy by dwelling on what I thought would be taken as a fairly obvious example of an inequity that results from the "normal functioning" of Big Science fields. This inequity is due to what Robert Merton has called "the principle of cumulative advantage," namely, the fact that the scientists whose articles are most likely to be cited are those who already have the most citations. The result is that in many of the hard sciences, 80-90% of the published work is never cited at all. Now, given that the training of scientists has increasingly stressed the importance of research just as the chances of any particular scientist being cited has diminished, it is difficult to resist the conclusion that a growing underclass of alienated workers has been created.

As it turns out, this conclusion was indeed resisted--by no less than President Bush's science advisor, Allan Bromley (who has apparently trained the most nuclear physicists in history). Bromley pointed out to me that the sharpness in this stratification of scientists indicated that the "invisible hand" of the peer review system worked a magic that could not be matched even by the capitalist marketplace. The last thing science needed, Bromley argued, was greater scrutiny, public participation, or state regulation. We definitely have our work cut out for ourselves.

---Steve Fuller
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REFERENCES

Fuller, Steve (1992). "STS as Social Movement: On the Purpose of Graduate Programs," *Science, Technology & Society*. 91:1-5.

Fuller, Steve (1993). *Philosophy, Rhetoric, and the End of Knowledge: The Coming of Science and Technology Studies*. Madison: Univ. of Wisconsin Press.

Ilerbaig, Juan (1992). "On the Sociological Revolution in STS: A Fuller Account." *Science, Technology & Society*. 92:1-3.

MacIntyre, Alasdair (1990). *Three Rival Versions of Moral Enquiry*. London: Duckworth.

Meister, Robert (1991). *Political Identity*. Oxford: Blackwell.

Shils, Edward (1992). "The Idea of the University: Obstacles and Opportunities in Contemporary Societies.: *Minerva* 30: 301-13.

Wuthnow, Robert (1989). *Communities of Discourse*. Cambridge: Harvard Univ. Press.

TECHNOLOGY AND HUMAN VALUES:

A BRIEF COURSE UPDATE AND SYLLABUS

Four years and twenty-four issues ago, I reported on my experience with teaching *Technology and Human Values*, the introductory survey course for the Lehigh University STS Program. In the intervening period, texts have changed and enough students have passed through the portals to warrant an update.

I have continued to use, and remain very pleased with, Rudi Volti's *Society and Technological Change*, which was updated in a second edition earlier this year. The main changes from the first edition were the addition of a chapter on environment and energy issues, and the condensation of three chapters on military weapons and society into two, along with a general updating of factual material. The text continues to receive strong student response for its readability and coverage of important topics and themes. For the past several years I have gone back to using Al Teich's *Technology and the Future* which has just come out in a revised sixth edition, albeit too late for use in the latest offering (see p. 18 of this issue for a review of the new edition). I have also continued to assign Don DeLillo's novel, *White Noise*, which provides a literary perspective on how technology affects us at the everyday level--the "white noise" of T.V., microwaves, supermarkets, and Coke and Toyota advertisements--as well as the more dramatic, if only seemingly more important, "airborne toxic event"--the release of a toxic chemical cloud that provides a central plot element of the novel. Students continue to enjoy the literary exposure to STS issues in part because of DeLillo's wonderfully satirical black humor. Finally, a more controversial book assigned for the first time this year was Judy Wajcman's *Feminism Confronts Technology*, with which students, especially the males, found themselves much less comfortable. See *STS Newsletter*, 88/89 (February/April 1992): 33, for a brief review of Wajcman's book.

In addition to these readings and a few selected videotapes, I continue to assign a "journal," a description of which is included in the syllabus following. Although students frequently find it a frustrating assignment at a routine level, from a broader perspective they recognize its worth, and I believe it shows them how current events in life outside the classroom complement their textbook readings. It also has the added virtue of getting them into the habit of routinely reading the newspaper. And finally, it nicely compliments the Volti text which includes comparative chapters on print and electronic media, especially television, communications. An optional extra-credit term paper was included this year. I must attribute most of the ideas for this assignment to Robert McGinn of Stanford's VTSS Program who described a similar set of requirements in his course description published in this *Newsletter*, issue #79 (September 1990): 11-19.

Finally, a brief word on the appended examination questions is in order. For the first time this year, I gave out a set of possible questions a week in advance of each of the two hour exams, promising I would choose only one to be written in-class (75 minutes). My rationale was to give students a set of questions that allowed me (and them) to cover the range of material, yet allow them plenty of time to actually write a coherent, well written and organized answer. With a fairly large class, it also provided the bonus of less grading, yet the reasonable assurance they had at least reviewed most of the relevant material. I was somewhat surprised both at how readily the students anticipated which question I would actually ask, and yet, at the same time in light of their insight, at how few did really well. The final exam, as is my usual wont in a course like this, was a fairly lengthy take home.

In general, I remain fairly well pleased with the way this course works, but I continue to tinker with it every offering, although not necessarily out of the expectation of finally "getting it right," for ideas and issues in STS are far too fluid and fast paced for that to ever happen, even if desirable.

COURSE SYLLABUS
TECHNOLOGY AND HUMAN VALUES

STS 11, Fall 1992
Tues-Thurs 10:45 - 12:00 noon

Dr. Stephen H. Cutcliffe
STS Program, Lehigh University

The interrelationship between society and technology is dynamic and inherently value-laden. Cultural, political, and economic values help to shape and direct technological development, which in turn can have a profound effect on those same social values and the society that holds them. In this course we will examine technology as a "social process" exploring social and ethical questions raised by the exploitation of technological innovations and discussing how society channels the work of scientists and engineers through institutions characteristic of the society: governmental, economic, corporate, educational, cultural. We will pursue this understanding through assigned readings, discussion, selected films, and a "technology journal."

There are four major texts for the course, each of which is available for sale in the bookstore. Other readings will be on reserve or made available in class. Assignments should be read prior to the class as the basis for discussion.

Don DeLillo. *White Noise* (N.Y.: Penguin, 1985).
Albert H. Teich, ed. *Technology and the Future*, 5th ed. (N.Y.: St. Martin's, 1990).
Rudi Volti. *Society and Technological Change*, 2d ed. (N.Y.: St. Martin's, 1992).
Judy Wajcman. *Feminism Confronts Technology* (Univ. Park: Penn State Press, 1991).
Students will also be expected to subscribe to and read the daily *New York Times.*

This course will be conducted as a mixed lecture/discussion format; thus all members will be expected not only to read the assignments, but to come to class prepared to discuss the readings and issues at hand. Since a portion of the final grade will be based on class participation, I will not look lightly upon repeated absences or a failure to join in discussion of the readings, films, etc.

Students will maintain a "technology journal" of *New York Times* newspaper clippings, reaction papers, observations, etc. pertaining to the subject matter of the course. The intent of the journal is to heighten student awareness of technology-related questions and issues and to help formulate an informed position or point of view regarding those issues. Clippings and observations will frequently provide material for classroom discussions. Journals will be reviewed by the instructor at three different times during the course of the semester (Oct. 6, Nov. 10, and Dec. 10). Late submissions will be penalized.

Optional Term Paper

Students may write for extra credit an optional short (5-6 page), analytical paper on a technology-society topic of interest to them. There will be three options. Instructions for each option follow; further details will be announced in class. These are the ONLY options. Submitting a term paper cannot hurt your grade, but will help those students in borderline situations. The maximum points available to be earned (but not automatically guaranteed) will be equivalent to half a letter grade.

OPTION 1.
Noteworthy but Neglected Influences of Technology on Society.

Based on appropriate background reading and research, you should briefly describe the technological influence, identify what developments in science and/or technology have given rise to it, and describe the associated societal impacts, be they positive, negative, or multi-faceted. You should comment both on why their chosen influence is noteworthy and on why it has been overlooked or given short notice, and on what this in turn says about American society.

Students should choose topics not covered in class or course readings; instead, topics should be unusual, even offbeat, but illuminating. For example, one might choose the influence of science and technology on toys, crime, or religion. Your *New York Times* clippings may give you some ideas, as may the articles in the Teich reader that we have not read in class.

OPTION 2.
Public Policies for Controlling Technology.

Based on appropriate background reading and research, you should describe a very specific policy which, if adopted, would enhance the public control of some aspect of technology in society. You should identify the situation or problem the policy is intended to shape or control, and clarify why you believe it of importance. You should also offer a realistic appraisal of the plausibility of the proposal being successfully adopted. You may also wish, where appropriate, to contrast the proposed policy with existing, less than satisfactory policy.

Students should choose topics that are imaginative but not utterly utopian with little or no real chance of adoption. Again, topics should not have been covered in class or assigned readings. Sample topics might include: policies for recycling at Lehigh, controlling computer network "viruses," or siting hazardous waste dumps. Your *New York Times* clippings may give you other ideas.

OPTION 3.
Social Issues Affected by Technology.

Students taking this option should choose an important social issue that has been (or might be) affected by technology. The paper should describe both the specific technology in question, as well as both its societal causes and consequences. You may choose a situation where the technological influence has (or might be) either positive or negative or has been two-sided. Where appropriate, you should also show how (or how not) this technology has been (or might be) shaped or controlled through the policy process.

Topics chosen should not have been previously covered in class or assigned readings. Sample topics might include: computers and privacy, automobile safety devices, ethical issues in medicine, or animal rights. Your *New York Times* clippings may give you other ideas.

Specific Instructions for Term Papers.

1. Topics should be selected and cleared with the instructor. A brief, one-page written proposal (not an outline) indicating the nature of your topic, why it is important, and how you intend to handle it must be submitted no later than Nov. 10. Submission of a preliminary bibliography at this time would be a good idea, but is not required.

2. Term papers should be approximately 5-6 pages in length, plus a bibliography of at least 5 books and/or articles. Your papers must be tightly organized and well written; free from grammatical, spelling, and typographical errors; and utilize a standard form of bibliographical referencing.

3. Students are urged to consult with the instructor regarding their paper and sources prior to final submission.

4. Papers are due no later than 4 p.m., December 21st.

The make-up of the final grade will be as follows:

1st Hour Exam ----------	20%
2nd Hour Exam ----------	20%
Technology Journal ----------	20%
Class Participation ----------	15%
Final Exam ----------	25%
Total ----------	100%

COURSE OUTLINE

Date	Topics and Readings
Tues. Sept. 1	Syllabus Handout and Introduction to Course. Why Study Technology--Some Definitions.
Thurs. Sept. 3	**Video:** ***Koyaanisqatsi*** (@90min., color, available from Pacific Arts Video, P.O. Box 22770, Carmel, CA 93922.) Read: Volti, Chapter 1. Write a brief one-page reaction paper to *Koyaanisqatsi*.
	Part I. Thinking About Technology
Tues. Sept. 8	**Technology's Impact on Society.** Discussion: Technology in Our Daily Lives Read: Volti, Chapter 2; Preface, Introduction and Marx essay in Teich, pp. iii-vii, 1-14.
Thurs. Sept. 10	**Perspectives on Technology.** Read: Morison and Weinberg in Teich, pp. 15-38.
Tues. Sept. 15	**Perspectives on Technology** - continued. Read: Mesthene, McDermott, and Florman in Teich, pp. 77-136.
Thurs. Sept. 17	**Perspectives on Technology** - continued. Read: Wajcman, Preface and Chapter 1.
	Part II. The Process of Technological Change
Tues. Sept. 22	**Sources of Technological Change and the Science/Technology Relationship.** Read: Volti, Chapters 3 and 4.
Thurs. Sept. 24	**The Diffusion of Technology.** Read: Volti, Chapter 5; Schumacher in Teich, pp. 223-30; Begin *White Noise.*

Tues. Sept. 29	**Technology and Sport.** Read: Continue *White Noise.*
Thurs. Oct. 1	**Discussion of *White Noise.*** Read: Finish *White Noise.*
Tues. Oct. 6	General Review and Discussion for Exam. Journals Due.
Thurs. Oct. 8	First Hour Exam.
Tues. Oct. 13	No class - Pacing Break.

Part III. Technology and the Environment

Thurs. Oct. 15	**An Historical Overview.** Read: Muir, Pinchot and Leopold handouts.
Tues. Oct. 20	**Technology and Environment.** Read: Volti, Chapter 6; Brown, et al in Teich, pp. 139-52.

Part IV. Technology and the Transformation of Work

Thurs. Oct. 22	**Work in Pre-Industrial Societies.** **Technology and Jobs.** Read: Volti, Chapters 7 and 8.
Tues. Oct. 27	**Technology and Jobs, continued.** Read: Volti, Chapter 9. Video: *Global Assembly Line*.
Thurs. Oct. 29	**Women and Work.** Read: Walshok in Teich, pp. 288-96. Wajcman, Chapter 2.

Part V. Communications and Information

Tues. Nov. 3	**Printing, Radio and Television.** Read: Volti, Chapters 10 and 11. Election Day: Get Out and Vote!
Thurs. Nov. 5	**Information Society.** TV Show Evaluations and Discussion. Read: Beniger in Teich, pp. 51-76.
Tues. Nov. 10	General Review and Discussion for Exam! Journals Due.
Thurs. Nov. 12	Second Hour Exam.

Part VI. Women and Technology

Tues. Nov. 17 **Women and Reproductive Technology.**
Read: Wajcman, Chapter 3.

Thurs. Nov. 19 **Women, Household Technology and the Built Environment.**
Read: Wajcman, Chapters 4 and 5.

Part VII. The Tools of Destruction

Tues. Nov. 24 **The Development of Weapons, Their Consequences and Control.**
Read: Volti, Chapters 12 and 13.
Video: *The Power Game*: Part 3. "The Pentagon."

Thurs. Nov. 26 No Class - Thanksgiving.

Part VIII. Shaping and Controlling Technology

Tues. Dec. 1 **Technology and Its Creators.**
Read: Volti, Chapters 14 and 15.
Wajcman, Chapter 6 and Conclusion.

Thurs. Dec. 3 **The Ethical Role of Engineers and Businessmen.**
Falsifying Data Scenario.
Read: Taft Broome, Jr. "The Slippery Ethics of Engineering" syndicated op-ed, *Bethlehem Globe Times*, Feb. 13, 1987.
Stephen H. Unger, "Ethics in Engineering: A Pressing Need," pp. 1-15 in *Ethics and Engineering*. Working Papers Series. (Bethlehem, PA.: STS Program, Lehigh University, 1985.)

Tues. Dec. 8 **The Role of Government in Forecasting, Assessing and Controlling Technology.**
Read: Volti, Chapter 16;
Porter, Drucker, and Lowrance in Teich, pp. 153-63, 180-206.

Thurs. Dec. 10 **Final Review and Evaluation.**
Read: Winner in Teich, pp. 262-76.

Journals Due.

FIRST HOUR EXAM QUESTIONS

The following exam questions basically cover the material we have read and discussed so far this semester. I will ask you <u>one</u> of these questions in class during the exam period. Clearly to be prepared you need to study all of the questions equally well (unless your gambler's instinct leads you to believe you will be particularly lucky at guessing which one I will choose).

You should plan on writing a coherently organized essay in your best prose style. You should present your overall thesis at the outset and then develop a well argued, organized, "critical" response to the questions and issues raised, supported with well-selected specific examples chosen from appropriate course materials (lecture/discussions, books/essays, film). Plan on leaving some time to proofread your answer.

1. Technological change is often equated with the idea or notion of social progress. Each of the authors and essayists (including the makers of the film *Koyaanisqatsi*) you have read comments on this important theme in technology studies in one way or another. Drawing specifically on each of the positions and arguments of Volti, Marx, Morison, Weinberg, Mesthene, McDermott, Florman, Schumacher, Wajcman, DeLillo, and the film, formulate and discuss your own view of whether or not technology has contributed to social progress.

   N.B. To answer this question well, you should do more that just summarize the positions of each of the authors we have read and then state your own view. Rather, as you develop the rationale for your own position, you should analyze what, in your own mind, are the strengths and weaknesses of each author's position and then integrate this analysis into your answer.

2. Technology as part of contemporary life is a major theme in Don DeLillo's novel, *White Noise*. Discuss and analyze his treatment of this theme, being sure to note the several different levels at which it occurs throughout the novel. Do you believe DeLillo's portrayal of technology in society is fair and accurate? What do you see as the novel's strengths and weaknesses?

3. A leading critic of technology has recently said that, "technology is the central factor in modern society; unfortunately it has taken on a life of its own and is out of control of human kind." Drawing on your reading to this point in the Volti textbook, the essayists in the Teich reader, and on the film "Koyaanisqatsi," analyze this quotation and indicate why you agree or disagree that technology is out of control.

4. The process of technological change and innovation is more complex than the traditional notion of technology as merely "applied science" would suggest. Using concrete examples to illustrate your points, discuss and analyze the process by which new technologies come into being. Be sure to include both the specific stages of the process as well as its societal context.

SECOND HOUR EXAM

The following exam questions basically cover the material we have read and discussed since the first exam. I will ask you one of these questions in class during the exam period. Clearly to be prepared you need to study all of the questions equally well (unless your gambler's instinct leads you to believe you will be particularly lucky at guessing which one I will choose).

You should plan on writing a coherently organized essay in your best prose style. You should present your overall thesis at the outset and then develop a well argued, organized, "critical" response to the questions and issues raised, supported with well-selected specific examples chosen from appropriate course materials (lecture/discussions, books/essays, film). Plan on leaving some time to proofread your answer.

1. Compare and contrast the respective roles of printing and of television in society. You should be as specific as possible, using appropriate examples, to illustrate both the positive and negative impacts of these communications technologies, as well as their societal rootedness. In conclusion, indicate whether you believe printing or television has had the greater influence in society, being sure to support your position with concrete reasons.

2. Work is generally accepted as an integral part of human existence. As with many other aspects of life, technology is intimately bound up with the process of work. Both Volti (p. 140) and Wajcman (p. 28) raise the fundamental question of whether technology determines the organization and process of work, or whether technology itself is shaped by existing economic, social, and perhaps even political relationships. Drawing on specific examples from Volti's and Wajcman's chapters on work, Walshok's article on women workers, and the "Global Assembly Line" video, discuss and analyze the relationship between work and technology. Some possible issues to consider in addition to the fundamental question raised by Volti and Wajcman is whether this relationship has changed over time, what role gender may play, and what the tradeoffs between beneficial and problematic technological changes have been.

3. The environmental well-being of our planet is often viewed as being at risk from technological changes and impacts. Both Volti and Lester Brown, et al, raise a number of environmental concerns and proffer some suggestions regarding possible solutions. Based on your analysis of their concerns and drawing upon the thoughts of Muir, Pinchot, and Leopold, explain what <u>you</u> believe to be our most important environmental issues (or possibly non-issues) and suggest what you think our most appropriate response(s) should be.

4. James Beniger suggests that computers and today's "information society" are not at all revolutionary. Describe in some detail what it is that Beniger does see as revolutionary and why, and then analyze whether you think his interpretation is correct based not only upon his information, but also upon the relevant readings on industrialization and work and on communications technology that you have read.

FINAL EXAM

Throughout the course of this semester I have argued that at root technology is a social process, i.e. one deeply embedded in society. If, indeed, this view that technology is a human creation, that it is "socially constructed," is true, it suggests there is room for human control over the shape and direction of technology, although at times it appears individual citizens may have little real say in the decision-making process. At the same time few would deny that technology has important effects upon society. It is precisely this complex set of relationships that this course, including our readings, the videos, and our class discussions, has attempted to come to grips with. Drawing on the <u>whole range</u> of material from the course, discuss and analyze the ways technologies are shaped by, and hence reflect, cultural and social, political, and economic values and relationships. In analyzing this social embeddedness, you should remember that society is not monolithic or homogeneous. You should also discuss what you perceive to be the strengths and weaknesses of our efforts to shape and control technology to constructive and socially positive ends.

Your answer to this question should be coherently organized, written in your best prose style, and preferably (although it is not required) word-processed or typed. You should present your overall thesis at the outset and then develop a well-argued, organized, "critical" response. Your answers should also be supported with well-selected <u>specific</u> examples, and where appropriate quotations, from the whole range of course materials, not only just those readings since the last hour exam, although I will be particularly interested in how you handle them. You should end your essay with a conclusion that summarizes and pulls your answer together. Please proofread your essays!

COURSE SYLLABUS

THE AMERICAN DREAM OF A PERFECT WORLD

UE 126
Fall, 1992
Seminar open to Freshmen only.

Judith Adams
SUNY-Buffalo

Objectives of the Course:

From Massachusetts Bay Colony to Walt Disney World, America has been convinced of its "mission" to create a perfect world from the New World Wilderness. John Winthrop affirmed the glory and the burden of the American enterprise in a sermon to his fellow colonists aboard the ship the Arbella in 1630: "We must consider that we shall be as a City upon a Hill, the eyes of all people are on us." Winthrop voiced the conviction of the colonists that the New World would be the locale of the eventual perfection of mankind, the actualization of the City of God on Earth. The Puritan ministers initially expressed the elements of the myth of the American Dream: the sense of geographic and personal election by God as the chosen People, faith in the idea of history as a course of "progress," a doctrine of American innocence, a belief in the purifying and strengthening power of the wilderness experience, the precedence of the community over the individual, the enshrinement of technology as utopian engineer.

The course traces the development of these ideas as a pervasive cultural myth which has centrally influenced the course of American history and civilization. The reflections of the myth in American culture are investigated from the Puritan settlements in Massachusetts to the rise of Walt Disney World in the swamps of Florida. The examination begins with seventeenth-century American Puritan sermons known as Jeremiads, then moves on to reveal the enduring vitality of the myth in the poetry of Walt Whitman, the technological sublime as depicted in nineteenth-century popular paintings and prints, the technological utopia actualized by the World's Columbian Exposition of 1893, F. Scott Fitzgerald's classic portrayal of the jazz age in *The Great Gatsby*, the Civil Rights Movement and the sermons of Martin Luther King, Jr., the satiric response to the Dream presented by Kurt Vonnegut's science fiction novel *The Sirens of Titan*, the personal achievement of the Dream and the quest for communal progress as articulated by Mario Cuomo, and finally, the perfect technological wonderland of Walt Disney World, the twentieth century's pilgrimage center.

Through readings, extensive class discussion, "reaction" papers, a multi-media project, and an 8-10 page term paper which applies the ideas presented in the seminar to an aspect of contemporary culture, the seminar poses the following questions: How successful has America been in achieving its Dream? What are the primary "tools" we have used in our attempts to achieve the Dream? How have we used the Dream to rationalize, gain support for, and legitimatize our personal actions and the collective "missions" of our country? Has the Dream been an inspiration or a burden? How have we visualized or actualized our Dream and our cultural aspirations? Has the Dream become a nightmare?

Course Requirements:

1. A brief (1-2) page reaction paper in which two articles related to civil rights or the American Dream are compared/contrasted. Students choose an article published in 1961-63 and an article appearing in 1991-92. Students consider whether the two articles reveal differences in American attitudes or values, the articulation of a sense of hope or despair, assumptions and stereotypes evident in the articles. Papers are shared with seminar participants and discussed in class.

2. A 1-2 page reaction paper to an assigned reading. In the Fall 1992 seminar of thirteen students, each student was assigned a specific chapter of *The Sirens of Titan*. Papers are discussed in class.

3. Two quizzes (no mid-term or final exam).

4. A multimedia project to be presented to the Seminar in a maximum of 15 minutes. The project must display an "actualization" of the American Dream myth and must involve visual or audio materials such as slides, music, photographs, advertisements, computer programs, computer games, videos, etc. Students may form teams or groups to produce joint projects.

   [In the Fall 1992 Seminar, students in groups of two or more developed video tapes interviewing students and faculty about their personal American Dreams and what their perfect world would be; one group edited video clips from situation comedies from the 50s to the 90s; another student prepared a video of clips from four science fiction movies, each depicting one element as the "hope" for a perfect world; other students looked at advertisements, especially the mass media concept of beauty.]

5. A term paper (8-10) pages applying the assigned readings and seminar discussions to an aspect of contemporary American culture. Students should be given some examples of aspects of their culture which could be analyzed from the perspective of the American Dream myth, such as:

   Rock music.
   1992 Olympic Games.
   Disintegration of the Soviet Union.
   Presidential election and its rhetoric.
   Movies, such as "Star Wars," "Terminator."
   High-tech medicine.
   Business tycoon like Iaccoca.
   The automobile.
   Dysfunction of American cityes--Los Angeles, New York, etc.
   Architecture of skyscrapers or shopping malls.
   Suburbia.
   AIDS epidemic.

[Titles of papers submitted by students in the Fall 1992 seminar are listed at the end of this syllabus.]

Grading:

ATTENDANCE, participation in seminar discussions and reaction papers: 25%.
Quizzes: 20%.
Multimedia Project: 25%.
Term Paper: 30%.

Course Outline:

Week 1: **Course overview and introduction.**

Getting acquainted with seminar participants. Each participant is asked to write (in class) a response to two questions: 1. What is your "personal" American Dream? 2. If you were running for President, how would you articulate the American Dream for our society as a whole?

The American errand in the New World wilderness: the Pilgrims, colonial culture, the sermons.

Sermon by John Winthrop.

Week 2: **Massachusetts Bay Colony, the centrality of religion, the Jeremiads.**

Sharing of student responses to American Dream questions.
Discussion of major formative ideas in the sermons. Sermons by William Stoughton and Peter Bulkeley.

Week 3: **Why do we "hate" to read sermons?**

Fay Weldon's futurist view of America: "Roseanda & Schwarzison--Politics and Adultery--a Legend in the Future Tense." (as an antidote to the "boring" 17th-Century sermons).

The Civil Rights movement and Martin Luther King. Viewing of video "Eyes on the Prize: No Easy Walk 1961-63." King's "Dream" sermons.

Week 4: **The rise of the individual, and Technology as utopian engineer.**

Walt Whitman's "Passage to India," "To a Locomotive in Winter," "A Woman Waits for Me."

The technological sublime. Consideration of the following paintings and prints:

George Inness:	"The Lackawanna Valley" 1855.
Currier & Ives:	"Across the Continent" 1868.
	"Night Scene at an American Railway Junction" 1876.
Lyonel Feininger:	"The Night Express" 1941.
	"The Disparagers" 1911.

Week 5-6: **The Celestial City actualized: The World's Columbian Exposition of 1893.**

The Exposition's enduring imprint on American culture.

Technology as progress. Slides of the Exposition.

Articles by Judith Adams, Robert Rydell, and Alan Trachtenberg.

Week 7: **Viewing of PBS video**: "The American Experience: Coney Island." Contrast Coney's atmosphere, purpose with the Columbian Exposition: "Columbian Exposition made American look good--Coney Island made America feel good" (comment by student in the Seminar).

Quiz.

Week 8-9: **The Dream apparently achieved, but is it a nightmare?**

F. Scott Fitzgerald's *The Great Gatsby*.

Technology as malefactor, the poverty and emptiness of wealth.

Advertisements, their power and influence (as demonstrated by automobile ads during the Gatsby era, the Roaring Twenties). Ads from *Vanity Fair* 1923-25.

Week 10 (one class): Mario Cuomo, the American Dream achieved and the resurrection of the value of community over the individual. Inauguration speeches as Governor of New York, 1983, 1987; nomination speech for Bill Clinton, 1992. [Cuomo is particularly appropriate for a SUNY class. Someone more relevant to a particular location, situation, etc. could be substituted.]

Weeks 10 -12 **Kurt Vonnegut's *The Sirens of Titan*.** A Jeremiad for the technological society. Mirroring of the structural pattern of the Jeremiads: initial catalog of wickedness and sin, a cleansing-enobling wilderness journey, emergence of the pilgrim in a state of innocence and love. Technology both helps and hinders the pilgrim in his journey. The communal Dream is immoral, the quest becomes an individual search for love and a friend.

Quiz.

Week 13: **"Wake Up in a Perfect World": Walt Disney World.**

The 20th Century's "Pilgrimage" center. Is this the best culmination of the American Dream? Decontextualized technology and Mickey Mouse history. Slides accompany discussion. Articles by Judith Adams, Alexander Morre, and Richard Corliss.

Weeks 14 -15 **Multimedia projects and papers, class presentations and discussion.**

Titles of papers prepared by students in the Fall 1992 semester:

The American Dream as Seen Through Contemporary Rock Music.
(Lyrics of "A Farewell to Kings" and "Subdivision" by Rush, "Sorrow" by Pink Floyd, and "Pride" by U2.)

The American Dream: Personal Fulfillment through Christian Religion.

The American Dream: Regular, Diet, or Caffeine-Free?
(Analysis of the Cola-wars advertising.)

The Assassination of John F. Kennedy: The Death of an American Dream.

The Automobile: An American Obsession.

The Bradys, The Bunkers, and the Bartman: Sit-com Families.

The Buffalo Bills and Community Identification.

Campaigns and the Media.
(Interviews with a number of local candidates and important politicos very near the Presidential election. Student worked for local Democratic Committee.)

It's Time to Wake Up from the American Dream.
(Personal account of the realization that the writer herself may not have total control of her ability to achieve her own dreams.)

The Olympics and the American Dream.

Ross Perot: American Dream or Nightmare?

The Schoellkopfs: The Model of the "American Dream" and their Dark Side.
(Wealthy, prominent Buffalo family who initally made their money by owning inhuman, filthy, crowded tenements.)

Virtual Reality.

Required Readings and Videos:

Listed in order according to the syllabus.
**Books to be purchased by students.

Winthrop, John. "A Modell of Christian Charity" (1630). In: *The Puritans*, edited by Perry Miller and Thomas H. Johnson. New York: American Book Co., 1938, pp. 195-99 [America as "City on a Hill"; also advocates a darker aspect of colonial culture: the belief that riches are bestowed by God to the Chosen few.]

Bulkeley, Peter. "A Willing and Voluntary Subjection" (1651). In: *Puritanism and the American Experience*, edited by Michael McGiffert. Reading Mass.: Addison Wesley, 1969, pp. 33-37. [Concept of the Chosen People, Chosen place; interesting imagery.]

Stoughton, William. "New-Englands True Interest; Not to Lie" (1670). In: *The Puritans*, pp. 243-46. [Declares that subjugation of the Native Americans is moral and just because they are savages.]

Weldon, Fay. "Roseanda & Schwarzison: Politics and Adultery: A Legend in the Future Tense," Harpers 284 (April 1992): 37-44.

King, Martin Luther, Jr. "The American Dream," and "I Have a Dream." In: *A Testament of Hope, the Essential Writings of Martin Luther King Jr.* Edited by James Melvin Washington. San Francisco: Harper and Row, 1986, pp. 208-20. "Letter From Birmingham Jail," *Christian Century* 80 (12 June 1963) 767-73.

Eyes on the Prize: America's Civil Rights Years: No Easy Walk 1961-63. (video) Directed, produced, and written by James A. DeVinney and Callie Crossley. PBS Video, 1986.

Adams, Judith. "The Form Emerges: The World's Columbian Exposition." In: *The American Amusement Park Industry: A History of Technology and Thrills*. Boston: Twayne, 1991, pp. 19-40.

Rydell, Robert. "World's Columbian Exposition." In: *All the World's a Fair: Visions of Empire at American International Expositions, 1876-1916.* Chicago: University of Chicago Press, 1984, pp. 38-71. [Emphasizes the racism within the Exposition.]

Trachtenberg, Alan. "White City." In: *The Incorporation of America: Culture and Society in the Gilded Age*. New York: Hill & Wang, 1982, pp. 208-34.

The American Experience: Coney Island. (video) Narrated by David McCullough, directed by Ric Burns. WGBH Boston, 1991.

**Fitzgerald, F. Scott. *The Great Gatsby* (1925). New York: Macmillan, 1988. (paperback).

Cuomo, Mario. Inauguration speeches as Governor of New York, 1983, 1987. In: *Public Papers of Governor Mario M. Cuomo*. Albany: State of New York, 1983, pp. 3-11; 1987, pp. 3-10. Nomination speech for Bill Clinton, Democratic National Convention, 1992. Unpublished, obtained from Democratic National Committee.

**Vonnegut, Kurt. *The Sirens of Titan* (1959). New York: Dell, 1970. (paperback)

Adams, Judith. "Walt Disney World Resort: Pilgrimage Center and 'Back to the Future' Utopia." In: *The American Amusement Park Industry*, pp. 137-61.

Moore, Alexander. "Walt Disney World: Bounded Ritual Space and the Playful Pilgrimage Center,"*Anthropological Quarterly* 53 (October 1980): 207-18.

Corliss, Richard. "If Heaven Ain't a Lot Like Disney," *Time* 127 (16 June 1986): 80-81, 83-84.

Additional Selected Bibliography

Books

Adams, Judith. *The American Amusement Park Industry: A History of Technology and Thrills*. Boston: Twayne, 1991.

Badger, Reid. *The Great American Fair: The World's Columbian Exposition and American Culture*. Chicago: Nelson Hall, 1979.

Baldwin, Leland D. *The American Quest for the City of God*. Macon, GA: Mercer University Press, 1981.

Baritz, Loren. *City on a Hill: A History of Ideas and Myths in America*. New York: John Wiley, 1964.

Bercovitch, Sacvan. *The American Jeremiad*. Madison: Univ. of Wisconsin Press, 1978.

----------. *The Puritan Origins of the American Self*. New Haven: Yale Univ. Press, 1975.

Burg, David F. *Chicago's White City of 1893*. Lexington: Univ. Press of Kentucky, 1976.

Hess, Hans. *Lyonel Feininger*. New York: Abrams, 1961.

Kasson, John F. *Amusing the Million: Coney Island at the Turn of the Century*. New York: Hill and Wang, 1978.

Ketterer, David. *New Worlds for Old: The Apocalyptic Imagination, Science Fiction, and American Literature*. Garden City, NY: Anchor Press/Doubleday, 1974.

Kiewe, Amos and Davis W. Houck. *A Shining City on a Hill: Ronald Reagan's Economic Rhetoric, 1951-1989*. New York: Praeger, 1964.

Marx, Leo. *The Machine in the Garden: Technology and the Pastoral Ideal in America*. New York: Oxford Univ. Press, 1964.

----------. *The Pilot and the Passenger: Essays on Literature, Technology, and Culture in the United States*. New York: Oxford Univ. Press, 1988.

Mayo, Clark. *Kurt Vonnegut: The Gospel from Outer Space*. San Bernardino: Borgo, 1977.

Miller, Perry. *Errand into the Wilderness*. Cambridge, MA: Harvard Univ. Press, 1956.

----------. *The New England Mind: From Colony to Province*. Cambridge, MA: Harvard Univ. Press, 1953.

Noble, David W. *The Eternal Adam and the New World Garden*. New York: George Braziller, 1968.

Tuveson, Ernest Lee. *Redeemer Nation: The Idea of America's Millenial Role*. Chicago: Univ. Chicago Press, 1968.

Articles

Bristol, Michael. "Acting Out Utopia, the Politics of Carnival," *Performance* 1 (May-June 1973): 13-28.

Brody, Michael. "Wonderful World of Disney: Its Psychological Appeal," *American Imago* 33 (Winter 1976): 350-60.

Corrigan, R.A. "Somewhere West of Laramie, On the Road to West Egg: Automobiles, Fillies, and the West in *The Great Gatsby*," *Journal of Popular Culture* 7 (Summer 1973): 152-58.

Doenecke, Justus D. "Myths, Machines, and Markets: The Columbian Exposition of 1893," *Journal of Popular Culture* 6 (Winter 1972): 535-49.

King, Margaret J. "Disneyland and Walt Disney World: Traditional Values in Futurist Form," *Journal of Popular Culture* 15 (Summer 1981): 116-40.

MacPhee, Laurence F. "The Great Gatsby's 'Romance of Motoring': Nick Carraway and Jordan Baker," *Modern Fiction Studies* 18 (Summer 1972): 207-12.

Murdock, Kenneth R. "Clio in the Wilderness: History and Biography in Puritan New England," *Church History* 24 (1955): 221-38.

O'Brien, Conor Cruise. "Purely American," *Harper's* 261 (April 1980): 32-34.

Smith, Michael L. "Back to the Future: EPCOT, Camelot, and the History of Technology," in *New Perspectives on Technology and American Culture*, edited by Bruce Sinclair. Philadelphia: American Philosophical Society, 1986.

Wallace, Mike. "Mickey Mouse History: Portraying the Past at Disney World." *Radical History Review* 32 (1985): 33-57.

OPEN FORUM

INAUGURATION OF THE DIBNER INSTITUTE

On October 22, 1992, the Dibner Institute for the History of Science and Technology was inaugurated at the Massachusetts Institute of Technology in opening ceremonies that featured keynote addresses by Institute director Jed Z. Buchwald and Thomas P. Hughes, Mellon Professor of the History of Technology at the University of Pennsylvania. The Institute is located in the newly-named Bern Dibner Building and houses the Dibner Library, one of the finest collections of rare books, manuscripts, instruments, and works of art related to the history of science and technology.

The creation of the research center and the relocation of the Burndy Library from Norwalk, Connecticut, was made possible by a gift from the Dibner Fund, a private foundation headed by David Dibner. The Institute was established as a consortium of MIT, Boston University, Brandeis University, and Harvard University. Its goals are to foster and disseminate outstanding scholarship in the history of science and technology and allied fields and to initiate new directions in these fields. Part of the affiliation agreement between MIT as the host institution and the Dibner Fund includes the establishment by the Fund of two new professorial chairs in the history of science and technology and four graduate student fellowships each year for MIT students. In addition to hosting distinguished scholars from around the world and supporting the dissertation research of advanced graduate students, the Institute will organize colloquia, workshops, seminars, and lecture series. Plans are underway, for example, for two international workshops--one on the European roots of the American System of Manufactures, the other on the role of the physical laboratory in late 19th-century British and German electro-technology research. Both are slated for the Spring of 1993.

A board of trustees, headed by David Dibner, oversees the Dibner Institute and Burndy Library. The Institute's first director is Jed Z. Buchwald, the newly appointed Bern Dibner Professor of the History of Science and Technology in MIT's Program in the History of Science and Technology and the History Faculty. A distinguished historian of physics, Buchwald comes from the University of Toronto, where he directed the Institute for the History and Philosophy of Science and Technology. He works closely with the Institute's executive director, Dr. Evelyn Simha.

In establishing the Institute, David Dibner is fulfilling the wishes of his late father, Dr. Bern Dibner. Founder of the Burndy Corporation and a life-long student of the history of science and technology, Bern Dibner began collecting scientific artifacts in 1936, when he went to Europe to study the life and works of Leonardo da Vinci. When his scientific collection outgrew the storage and display facilities of his corporate offices, Dr. Dibner had a separate library building constructed across the street; there he pursued his own research on the history of science and technology and opened his collection to local school children as well as to scholars from around the world. By the time of his death in 1988 at age 90, Bern Dibner had amassed an impressive collection of some 40,000 rare books, manuscripts, and scientific artifacts. He also had donated a thousand books form his Leonardo da Vinci collection to Brandeis. In 1976, he gave more than 11,000 rare books and manuscripts and other items to the Smithsonian Institution. And in 1981, he established the Vito Volterra Center at Brandeis where the library of the great Italian scientist and inventor is open to the international community of scholars. Among the priceless holdings coming to MIT are original editions of the great classics of early modern science, selected volumes from Louis Pasteur's personal library, a 14th-century monastery bell mounted on a bearing designed by Leonardo da Vinci, notes of Albert Einstein, a prototype of a battery created by the Italian scientist Volta, a page with handwritten corrections form Darwin's *Origins of Species*, and a letter from Galileo describing the invention of the magnetic clock.

AN INTRODUCTION TO THE DEPARTMENT OF PHILOSOPHY AND SCIENCE AT SOUTHEAST UNIVERSITY, NANJING, CHINA

The Department of Philosophy and Science at Southeast University supports graduate study and engages in scientific research work. There are three divisions in the department: Science and Technology Studies, Ethics of Science and Technology, and Philosophical Problems in Science and Technology. Science and Technology Studies emphasizes such issues as how science and technology are transformed into productive forces. Ethics of Science and Technology studies the ethical and value dimensions of science and technology. Philosophical Problems in Science and Technology focuses on the development of science and technology, and on the philosophical problems raised in the various branches of science and technology. In recent years, the faculty of the department have published over thirty books and more than four hundred articles.

The department wishes to cooperate with similar departments in the following areas: 1. Cooperative research in the field of social studies of science and technology. 2. Faculty and graduate student exchanges. 3. Interchange of information and references. For more information, please contact: Mr. Fan Heping, Chairman, or Mr. Liu Lang, Vice Chairman, Department of Philosophy and Science, Southeast University, Nanjing 210018, The Peoples' Republic of China.

ENVIRONMENTAL POLICY STUDIES AT NEW JERSEY INSTITUTE OF TECHNOLOGY

A new interdisciplinary M.S. degree program offers preparation in environmental policy and related areas to serve government, the non-profit sector, and business. The curriculum is particularly strong in making connections between political science, economics, communications, history and ethics. The program's goal is to produce graduates who have the integrated knowledge, the administrative and communications skills, and the understanding of fundamental ethics and values to intelligently address and solve environmental problems. The program is situated in New Jersey's comprehensive technological research university that emphasizes environmental science and engineering. Fourteen faculty offer a 30-36 credit M.S. degree consisting of a core curriculum, area concentrations, internships, and a final thesis or project. Part time or special students are also welcome. Limited student support is available. For further information contact John Opie, Department of Social Science and Policy Studies, New Jersey Institute of Technology, Newark, N.J. 07102. Phone 201-596-3676/3270, fax 201-565-0586, E-Mail NJITGW::Admin1.Opie.

EMPLOYMENT OPPORTUNITIES

The following announcements are drawn from a variety of sources including materials submitted directly. The *STS Newsletter* and its staff cannot assume any responsibility for the accuracy of any listing, and potential applicants should check carefully all details, especially closing dates.

University of Virginia, Charlottesville.

Humanities and Social Science Approaches to Engineering and Applied Science. School of Engineering and Applied Science, is seeking a chairperson and full professor for its non-degree-granting Humanities Division. Through both research and undergraduate teaching, the Division interprets the humanities and social sciences in the context of professional engineering education. The Division helps direct undergraduate engineering theses and offers courses on professional communications and the interaction of technology, society, and culture. The chair teaches regularly in all areas of the instructional program. Applicant must demonstrate significant research and teaching accomplishments in using humanities and social science approaches to investigating technology or applied science, and he or she should be committed to teaching in a professional school environment. Candidates trained in traditional humanities and social science fields and individuals trained in interdisciplinary fields are encouraged to apply. The Division includes scholars from several disciplines, and the chair must be able to work with individuals from diverse backgrounds to advance research and undergraduate teaching. Deadline for application letter, CV, selected publications, and three letters of support is February 15, 1993. Write to Chair, Search Committee, Humanities Division, Thornton Hall, University of Virginia, Charlottesville, VA, 22903. The University of Virginia is an Equal Opportunity/Affirmative Action employer.

Carleton College, Northfield, Minnesota.

Carleton College invites applications for one-term visiting appointments to the Winifred and Atherton Bean Chair in Science, Technology and Society during 1993-94 and 1994-95. The Bean Chair supports the curriculum of the Technology and Policy Studies (TAPS) Program, an interdisciplinary concentration focusing on public policy issues related to science and technology. Candidates should have a distinguished record of teaching and scholarship in STS, regardless of disciplinary background. Appointments are normally made for one 10-week term (fall, winter, or spring), but other arrangements may be possible. Applications for 1993-94 were due January 1, 1993, but are still being accepted for 1994-95. They should include letter of interest, curriculum vitae, and list of three references, and should be sent to Norman Vig, Political Science Department, Carleton College, Northfield, MN 55057.

Massachusetts Institute of Technology, Cambridge, Massachusetts.

The Program in Science, Technology, and Society at the Massachusetts Institute of Technology awards one-year postgraduate Mellon Fellowships in the History and Social Study of Modern Life Sciences. Appointments will be based on quality of scholarly work (published or unpublished) and on a commitment to continuing research. Applicants whose research interests coincide with the theme of the annual workshop for 1993-94--comparative institutional contexts for 20th century life sciences--are especially encouraged to apply. While most applicants will have completed their Ph.D.s in the years just preceding their prospective terms as Fellows, the Program may also consider more junior and senior applicants. Fellows will be expected to contribute to departmental colloquia and Mellon workshops and will be invited to participate in graduate seminars. The annual stipend is $30,000. Applicants should send letters describing their research interests and work, curriculum vitae, and three letters of support from qualified scholars by February 1, 1993, to the Mellon Fellowship Committee, Program in Science, Technology and Society, Massachusetts Institute of Technology (E51-201), Cambridge, MA 02139; [617] 253-9759; fax [617] 258-8118.

Institute of Technology, State University of New York at Utica/Rome.

The School of Arts and Sciences of the State University of New York Institute of Technology at Utica/Rome seeks to appoint a tenure-track assistant professor to teach courses in History of Science and Technology, and in American and European history, to support and enrich curricula of students in other degree programs. Applicants should have a Ph.D. in History and be committed to excellence in undergraduate teaching, with a teaching load of three courses per semester (12 hours/week). Applicants should submit by February 15, 1993 letters of application, current curriculum vitae, and three letter of reference to Anthony F. Paneblanco, Director of Personnel/AA, SUNY Institute of Technology at Utica/Rome, Drawer 245, P. O. Box 3050, Utica, NY 13504-3050.

Southern College of Technology, Atlanta, Georgia.

Southern College of Technology (in the metro-Atlanta area) invites applicants for a tenure-track assistant professor in History of Science and/or Technology, to begin September 1993. At first, main duties will consist of teaching survey courses in American history with an occasional upper-level history of science and/or technology class. The individual hired must have a doctorate (in hand by June 1993) in history, with a major field in the history of science and/or technology, and the ability to teach American history survey courses. The individual may also serve as a co-director of "Interface," the annual interdisciplinary conference that seeks to integrate science, technology, and the humanities, and, preferably, could teach survey courses in philosophy and/or ethics. Candidates must submit a letter of application, curriculum vitae, graduate transcripts (official or unofficial), and three current letters of recommendation by February 19, 1993, to W. S. Pfeiffer, Humanities and Social Sciences Department, Southern College of Technology, 1100 South Marietta Parkway, Marietta, GA 30060.

University of Massachusetts, Lowell, Massachusetts.

The University of Massachusetts invites applications for a tenure-track assistant professorship in the history of science, to begin September 1, 1993, subject to funding. The Ph.D. is required and salary is commensurate with qualifications and experience. Specialists in all aspects of the history of science will be considered, but applicants should have broad interests and be prepared to teach one or more undergraduate survey courses in the history of science, and also a survey course in one of the following areas: European, American, Asian, or world history. Applicants should send a resume, transcripts, course proposals, and a list of three references to Charles Carroll, Department of History, University of Massachusetts Lowell, One University Avenue, Lowell, MA 01854. Deadline for receipt of completed applications is April 1, 1993.

Brooklyn College of the City University of New York.

Anticipated faculty positions--Fall 1993. Education: teach in Science Education with an emphasis on grades K-12. Besides a Doctorate, applicants must have at least a Master's degree in the sciences and bring interdisciplinary and critical theoretical perspectives to the study of science in contemporary culture. Urban teaching experience is an advantage. Appointments are at the Assistant Professor level. Candidates are expected to teach in both undergraduate and graduate programs, to conduct research and to participate in curriculum development and other departmental activities. Demonstrated excellence in teaching and a significant research and publication record are essential. Brooklyn College is a comprehensive liberal arts institution located on a 26 acre campus in an urban setting, serving 16000 students in 95 undergraduate and 83 graduate programs. The College is committed to providing the highest quality education to students of diverse ethnic, religious, and economic backgrounds. All appointments are subject to financial ability. Salary range is commensurate with qualifications and experience. Assistant Professor, $28,630-$46,176--including complete benefits package. Send resume and three references by March 20, 1993, to: Dr. Joan V. Rome, Director, Personnel Services and Labor Relations, Brooklyn College/CUNY, Brooklyn, New York 11210.

Stanford University, Stanford, California.

Faculty position available for teaching in STS, Western Culture, and Engineering. The interdisciplinary Program in Values, Technology, Science, and Society in the School of Engineering at Stanford University, in cooperation with the departments of the School, invites applications for a non-tenure-line position at the level of Associate Professor (teaching). Applicants should have earned a doctorate in engineering, the social sciences, or the humanities and have a strong interest and demonstrated excellence in undergraduate instruction. The person selected will be expected to (1) teach a course or courses of his/her choosing appropriate and valuable to a science, technology, and society (STS) Program; (2) lecture and lead discussion sections in a first-year course in "western culture," with focus on the interaction of technology and science with other aspects of culture and on the interplay of western with non-western cultures; and (3), depending on the candidate's interest and experience, contribute to the teaching program in some area of concern to a department in the School of Engineering (e.g., design, environmental problems, technology policy, computer applications, etc.). The position does not itself entail research. Evidence of scholarly activity and writing in STS or the candidate's specialty, however, will be regarded favorably. Applications should include a summary of educational and professional background, evidence of teaching experience in the subjects specified (including student or faculty evaluations if available), brief discussion of STS courses and area of engineering teaching the candidate proposes, list of any published work, and names of three references who may be consulted about the applicant's qualifications. They should be sent to: Prof. Walter G. Vincenti, Chair, Program in Values, Technology, Science and Society, Building 370, Stanford University, Stanford, CA 94305-2120. Applications must be received by April 15, 1993; the appointment is expected to be effective September 1, 1993.

Pennsylvania Historical and Museum Commission, Harrisburg, Pennsylvania.

The PHMC anticipates the appointment in early 1993 of an Industrial History Specialist, with background in labor, business, technology, or related field, to manage public programs and conduct related research projects. The position requires MA degree and/or experience. Competitive salary and benefits. Application deadline is March 5, 1993. For application materials, contact Robert Weible, Division of History, PHMC, Box 1026, Harrisburg, PA 17108; [717] 787-3034. Women and minorities strongly encouraged to apply.

Teich, Albert H., ed., *Technology and the Future*. 6th ed. New York: St. Martin's, 1993. xiv, 385 P. Paperback. $22.00.

Technology and the Future continues to be one of the more widely used anthologies for undergraduate STS courses, and St. Martin's has recently published a revised sixth edition. As with the previous edition, this latest is divided into four major sections.

Part 1. **THINKING ABOUT TECHNOLOGY** retains a number of old favorites while adding two new "thinkers"; specific contents include:

Leo Marx, "Does Improved Technology Mean Progress?"
O. B. Hardison, Jr., "Disappearing through the Skylight."
Alvin M. Weinberg, "Can Technology Replace Social Engineering?"
James R. Beniger, "The Control Revolution."
Wendell Berry, "Why I Am Not Going to Buy a Computer."
Emmanuel G. Mesthene, "The Role of Technology in Society."
John McDermott, "Technology: The Opiate of the Intellectuals."
Samuel C. Florman, "Technology and the Tragic View."

Part 2. updates and expands upon **FORECASTING, ASSESSING, AND CONTROLLING THE IMPACTS OF TECHNOLOGY** and includes:

Lester R. Brown, "The New World Order."
Herb Brody, "Great Expectations: Why Technology Predictions Go Awry."
Paul Ceruzzi, "An Unforeseen Revolution: Computers and Expectations, 1935-1985."
William W. Lowrance, "Choosing Our Pleasures and Our Poisons."
Corlann Gee Bush, "Women and the Assessment of Technology."
Allan C. Mazur, "Controlling Technology."

Part 3. offers five alternative perspectives on **RESHAPING TECHNOLOGY**:

E. F. Schumacher, "Buddhist Economics."
Paul Goodman, "Can Technology Be Humane?"
Mary Lindenstein Walshok, "Blue Collar Women."
Robert C. Johnson, "Science, Technology, and Black Community Development."
Langdon Winner, "Artifact/Ideas and Political Culture."

Finally, Part 4. on **USING TECHNOLOGIES AND CONFRONTING THEIR DILEMMAS** is almost completely revised from the previous edition and includes six essays, five of which are new, on specific technologies of current interest:

Fred M. Frohock, "Special Care: Medical Decisions at the Beginning of Life."
Robert A. Weinberg, "The Dark Side of the Genome."
Ruth Schwartz Cowan, "Less Work for Mother?"
Shoshana Zuboff, "In the Age of the Smart Machine."
Howard Rheingold, "Virtual Reality and Teledildonics."
Stephen J. Kline and Don E. Kash, "Technology Policy: What Should It Do?"

Section introductions and brief headnotes are utilized to place the selections and their authors in an appropriate context. As with past editions, Teich's latest selection of essays will make an excellent text in a wide variety of STS courses.

M*E*T*A*
Mankind, Ethics, Technology and the Arts
Recent Publications

ACHESON, ROY M. *WICKLIFFE ROSE OF THE ROCKEFELLER FOUNDATION: 1862-1914, THE FORMATIVE YEARS*. CAMBRIDGE, ENGL.: KILLYCARN PRESS, 1992. 99 P. ILLUS, MAPS, BIBLIOG. PAPERBACK: $17.50.

Rose was a philanthropic administrator of the Rockefeller Foundation active both in its education and health efforts. This brief monograph covers the early years of Rose's work for the Foundation. A full biography is also in the process of being completed.

AIKENHEAD, GLEN. *LORST: LOGICAL REASONING IN SCIENCE AND TECHNOLOGY*. TORONTO: JOHN WILEY & SONS OF CANADA, 1991. XIV, 381 P. ILLUS. PAPERBACK: $20.00.

A student text that examines the scientific, technological and societal issues revolving around alcohol and drinking by drawing on the tragic, alcohol-related automobile death of Philadelphia Flyers' goalie Pelle Lindbergh. The units and activities in this text are designed to make students aware both of the nature and processes of science and technology and of the social and value issues related to science and technology. This is an excellent, well-illustrated STS text focusing on an issue that should be of central concern to students. *[Teacher's Guide* also available, paperback $40.00.]

BENNETT, SCOTT, ED. *TECHNOLOGY AND WORK IN CANADA*. CANADIAN STUDIES, 8. LEWISTON, N.Y.: EDWIN MELLEN PRESS, 1990. XXI, 295 P. HARDCOVER: $89.95.

Proceedings from a conference on the impact of technology on labor and the work process. Contents include: Part I: Concepts of Technology and Its Relation to Labour: "Information Technology and the Commoditization of Content," by Arthur J. Cordell; "Thinking What We Do: Technology and the 'Human Factor'," by Peter C. Emberley; "Technology and the Conserver Society," by Lionel Rubinoff. Part II: Historical and Conceptual Overviews of the Evolution of Technology and Work: "The Future of Work: An Overview," by Roy Hanna; "Will More Technology Mean Fewer Jobs?" by William Sheridan; "An Archaeology of Technics and the Working Life," by Jon Alexander and James MacAulay. Part III: Specific Empirical Studies of Technological Impact: "The Impact of Technological Change on Secondary Manufacturing in Metropolitan Toronto," by David A. Wolfe and David Sobel; "Attitudes of Public Sector Clerical Workers Toward Office Automation," by Eugene Swimmer and Madeline McNicoll; "New Work Organized on Post-Taylorist Principles: Case Study Evidence and Conceptual Conclusions," by Ken Hansen. Part IV: General Perspectives on Policy Relating to Technology and the Labour Force: "Policies for Adjustment to Technological Change," by Keith Newton, Gordon Betcherman, Kathryn McMullen and Norm Leckie; "A Critical Examination of Policy Proposals for Dealing with the Effects of New Technologies on the Nature and Distribution of Work," by Sally Lerner; "Proposals for Future Public Policy on Technological Impacts on Unemployment and the Labour Force," by Nancy Riche; and "Labour Force Readiness for Technological Change and Emerging World Competitiveness," by Lynn E. Burton.

BROWN, LESTER R.; CHRISTOPHER FLAVIN; AND HAL KANE. *VITAL SIGNS 1992: THE TRENDS THAT ARE SHAPING OUR FUTURE*. WASHINGTON, D.C.: WORLDWATCH INSTITUTE, 1992. 131 P. PAPERBACK: $10.95.

The latest in the mutually reinforcing set of publications from the Worldwatch Institute is *Vital Signs*, a projected annual compilation of global environmental data. Viewed as a companion volume to the Institute's *State of the World*, this new publication will provide a core set of indicators including such trends as grain production, carbon emissions, population growth, etc. Although some content will vary from year to year, the intent is to provide an accessible, up-to-date reference work in order to assist in better understanding of our changing world.

CAVE, JANE, AND MARK FRANKEL. *BREAKING FROM THE PAST: SETTING NEW GROUND RULES FOR SCIENTIFIC FREEDOM AND RESPONSIBILITY IN EAST-CENTRAL EUROPE AND THE RUSSIAN FEDERATION*. WASHINGTON, D.C.: DIRECTORATE FOR SCIENCE AND POLICY PROGRAMS, AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, 1992. 78 P. COPIES AVAILABLE AT NO CHARGE BY WRITING OR CALLING MAGBY CALLEJAS, AAAS, 1333 H ST., N.W., WASHINGTON, D.C. 20005; [202] 326-6600.

Breaking From the Past summarizes the results of over 100 interviews with scientists, engineers, and educators in East-Central Europe and the former Soviet Union on what they regard as the most pressing issues concerning scientific freedom and responsibility in those countries. Among the key issues covered are: the relationship of science and politics, influence of funding sources, emergence and maintenance of a self-regulating scientific community, the development and teaching of ethical standards, peer review, public communication of science, and

the social responsibilities of scientists. You obviously cannot beat the price for this useful little monograph.

GORMAN, MICHAEL E. *SIMULATING SCIENCE: HEURISTICS, MENTAL MODELS, AND TECHNOSCIENTIFIC THINKING*. SCIENCE, TECHNOLOGY, AND SOCIETY SERIES. BLOOMINGTON: INDIANA UNIV. PRESS, 1992. XX, 266 P. ILLUS. HARDCOVER: $45.00.

Gorman, a psychologist, provides an autobiographical account of his own experimental research program on the cognitive processes associated with scientific research and subjects it to "reflexive scrutiny." This simultaneously personal and objective account thus "subject[s] scientific reasoning to controlled laboratory study and analyze[s] the social context out of which such studies emerge" (p. xviii). He also presents and critiques the possibilities of computer programs for modelling scientific discovery and offers a cognitive framework utilizing a case study of the telephone's invention. Ultimately it is Gorman's concern that, in unpacking the black boxes of science, social scientists "determine whether we are talking about aspects of the same techno-science and, if we are, how we can learn from each other" (p. xx). "If there is a moral to this lengthy autobiography of a research program, it is that to understand techno-scientific thinking one must transcend traditional disciplinary and methodological ideologies" (p. 234).

INKSTER, IAN. *SCIENCE AND TECHNOLOGY IN HISTORY: AN APPROACH TO INDUSTRIAL DEVELOPMENT*. NEW BRUNSWICK, N.J.: RUTGERS UNIV. PRESS, 1991. XVI, 391 P. HARDCOVER: $50.00.

A comparative analysis of science, technology, and industrial development in the world economy primarily in the eighteenth and nineteenth centuries, although a concluding chapter points to twentieth-century "aftermaths." Inkster is more concerned with the processes of technology transfer and diffusion for their roles in economic development than he is with invention per se. He draws upon research, both his own and that of others, for Britain, Australia, Europe, Japan, China, India, and the U.S., thus providing a broad-ranging treatment of modern economic and development institutions and processes. Useful for advanced students and scholars alike.

LENSSEN, NICHOLAS. *EMPOWERING DEVELOPMENT: THE NEW ENERGY EQUATION*. WORLDWATCH PAPER, 111. WASHINGTON, D.C.: WORLDWATCH INSTITUTE, 1992. 57 P. PAPERBACK: $5.00.

In contrast to conventional energy development and use, *Empowering Development* proposes a conservation/efficiency strategy. "By investing in more efficient factories, appliances, and transportation, and in new energy supplies [natural gas and renewable energy technologies, including photovoltaics], developing nations can save hundreds of billions of dollars, reduce pollution, and make their economies more productive."

PACEY, ARNOLD. *THE MAZE OF INGENUITY: IDEAS AND IDEALISM IN THE DEVELOPMENT OF TECHNOLOGY*. 2D ED. CAMBRIDGE, MA: MIT PRESS, 1992. X, 306 P. ILLUS, MAPS, BIBLIOG. HARDCOVER: $25.00; PAPERBACK: $12.95.

A valuable update of Pacey's classic one-volume synthesis of technology in western civilization from the medieval cathedral builders to the twentieth century. This edition includes several new and refocused chapters that extend the author's earlier analysis of nineteenth-century engineering and industrialization and sketch out a number of "idealistic trends" in the twentieth century including scientific planning, post WW II science policy, utopian architecture, and alternative technologies. A useful text for a variety of STS and especially history of technology courses.

POSTEL, SANDRA. *LAST OASIS: FACING WATER SCARCITY*. WORLDWATCH ENVIRONMENTAL ALERT SERIES. NEW YORK: W. W. NORTON, 1992. 240 P. MAPS. PAPERBACK: $9.95.

Last Oasis, the third volume in Worldwatch's Environmental Alert Series, projects that water scarcity may be to the 1990s what oil price shocks were to the 1970s, affecting everything from food supplies to global security. Postel argues cost-effective conservation measures--our "last oasis"--are available to alleviate such pressures and meet water needs. Reminiscent of Aldo Leopold's *Sand County Almanac* plea for a "land ethic," *Last Oasis* concludes with a call for a new "water ethic." Such an ethic would seek to protect natural ecosystems and support an equitable use of water, an approach fully in keeping with the Worldwatch Institute's and much of environmentalism's increased focus on "sustainability."

PREER, ROBERT W. *THE EMERGENCE OF TECHNOPOLIS: KNOWLEDGE-INTENSIVE TECHNOLOGIES AND REGIONAL DEVELOPMENT*. WESTPORT, CONN.: GREENWOOD, 1992. X, 189 P. BIBLIOG. HARDCOVER: $42.95.

An examination of high-technology-based regional development to determine why and how such regions have emerged and what promotional policies have been utilized. Examples include Rte. 128 and Silicon Valley.

FORTHCOMING MEETINGS AND CONFERENCES

February 12-14, 1993. *Inner Space, Outer Space: Humanities, Technology, and the Postmodern World*. Univ. of Alabama, Huntsville, AL. The Southern Humanities Council 46th Annual Meeting. Contact: Daniel Schenker, Dept. of English, Univ. of Alabama, Huntsville, AL 35899. FAX: [205] 895-6949.

February 25-26, 1993. *Sigma Xi Forum on Ethical Issues in Science*. San Francisco. Contact: Linda Rey, Sigma Xi, P.O.Box 13975, Research Triangle Park, NC 27709. Phone: [800] 243-6534 or [919] 549-4691; FAX [919] 549-0090.

February 25-27, 1993. *Transmission of Science: Cultural Exchange in the Premodern World*. Univ. of Oklahoma, Norman, OK. Contact: Steven J. Livesey or F. Jamil Ragep, History of Science, Univ. of Oklahoma, 601 Elm, Room 622, Norman, OK 73019. Phone: [405] 325-2213; FAX: [405] 325-2363; Email: aa9214@uokmvsa.bitnet.

March 6, 1993. *12th Annual Graduate Student Conference in the History, Sociology, and Philosophy of Science, Technology and Medicine*. Yale University. For information or to submit one page abstracts due by January 18, 1993, contact: James Hanley, History of Medicine Section, Yale University School of Medicine, 333 Cedar St., New Haven, CT 06510-8015; FAX [203] 737-4130 or Carolyn Shapiro, e-mail: Shacarg@YaleVM.YCC.Yale.edu.

March 13, 1993. *Science and Technology for the 21st Century*. New Jersey Institute of Technology, Newark. Keynote address and hands-on workshops appropriate for K-12 teachers. Co-sponsored by NJSTA, Teachers' Clearinghouse, and NASTS. Cost: $10.00. For information or to register, contact E.J. Piel, 192 Gould Ave., N. Caldwell, NJ 07006-4214, or call Beverly Nelson, Phone: [201] 612-0596.

April 5-7, 1993. *Resistance to New Technology, Past and Present*. Science Museum, London. Historical and sociological comparison of patterns of public response to post-war nuclear power, information technology, and biotechnologies. Contact: Martin Bauer, Science Museum Library, London SW7 5NH, U.K. Phone: [071] 938-8241; FAX: [071] 938-8213.

May 21-23, 1993. *VII Biennial Congress of the Society for Philosophy of Technology*. Valencia, Spain. Special theme, "Technology and Ecology," but sessions on other topics are also included. Contact: Larry Hickman, Dept. of Philosophy, Texas A&M Univ., College Station, TX 77843-4237.

May 27-28, 1993. *European Responses to the Post-War Electronics Challenge: Research, Business, and Politics*. Paris. Sponsored by the Centre de Recherche en Histoire des Sciences et des Techniques. For further information contact: Antonio Botelho, Kellogg Institute, Univ. of Notre Dame, Notre Dame, IN 46556. Phone: [219] 239-5179; FAX [219] 239-6717; e-mail: botelho@athena.mit.edu, or Francois Jacq, Centre de Sociologie de l'Innovation, Ecole de Mines, 62 Bd. Saint Michel, 75272 Paris Cedex 06, France; Phone: 33-1-40-519282; FAX: 33-1-43-545628.

June 3-5, 1993. *Lowell Conference on Industrial History--The Meaning of Slavery in the North*. Lowell, MA. Links between slavery and the textile industry--workshops, media and living history presentations, panel discussions and speakers. For information contact: Marty Blatt, Historian, Lowell National Historic Park, 169 Merrimack St., Lowell, MA 01852; Phone: [508] 459-1027.

July 14-18, 1993. *Sixth Biennial Meeting of the International Society for the History, Philosophy and Social Studies of Biology*. Brandeis Univ., Boston. Contact: Patricia Williams, IS/HPSSB Program Chair, P. O. Box 69, Covesville, VA 22931; E-mail: PW9H@VIRGINIA.EDU. For local arrangements, contact: Michael Lynch, Sociology Dept., Boston Univ., 96-100 Cummington St., Boston, MA 02215. Email: SOC8ARN@BUACCA.

September 8-11, 1993. *Technological Change*. Rhodes House, Univ. of Oxford, England. Co-sponsored by the British Society for the History of Science. Contact: Robert Fox, Modern History Faculty, Broad St., Oxford OX1 3BD, England. FAX: 086-525-0704.

October 14-17, 1993. *Society for the History of Technology Annual Meeting*, National Air and Space Museum, Washington, D.C. 3 copies of paper and panel proposals, including 150-200 word summaries and vitae for each presenter, should be submitted by Feb. 1, 1993, to Philip Scranton, Center for History of Business, Technology and Society, Hagley Museum and Library, P. O. Box 3630, Wilmington, DE 19807; Phone: [302] 658-2400.

October 15-17, 1993. *History of Science and Technology Education in Canada, 8th Kingston Conference*. Kingston, Ontario. Contact: Marianne Ainley, Simone de Beauvoir Inst., 1455 de Maisonneuve Blvd., W., Montreal, Quebec H3G 1M8. Phone: [514] 848-2374; FAX: [514] 848-2370.

November 18-21, 1993. *Possible Worlds, Alternate Realities: Literature and Science as World-Making*. Society for Literature and Science, Annual Meeting. Boston. For information or to submit abstracts for papers and sessions by March 1, 1993, contact: Alvin Kibel, Literature Dept., MIT, Cambridge, MA 02139.

November 19-22, 1993. *Society for the Social Studies of Science Annual Meeting*. Purdue Univ., W. Lafayette, IN. Paper and panel proposals with 150 words abstract due by March 1, 1993. Contact: Tom Gieryn, Dept. of Sociology, Indiana University, Bloomington, IN 47405.

October 13-16, 1994. History of Science Society, Society for the Philosophy of Science, and Philosophy of Science Association joint meeting. New Orleans. Watch future issues for proposal deadlines and information.

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Science, Technology & Society is a newsletter devoted to the general area of science, technology, and society studies. It is a joint project of the Lehigh University STS Program and the Technology Studies Resource Center and publishes short articles on the theoretical and speculative aspects of curriculum development, in-depth program and course descriptions, reviews of texts and audio-visual aids, and an annotated bibliography of current books and articles. An 'Open Forum' section exists for readers with questions, comments or announcements regarding STS courses or needs. Our goal is to help generate new courses, and provide an information exchange in the STS field. Subscriptions, covering six issues, are available for $8.00 per year--checks payable to Lehigh University. Back issues are available for $1.50 each.

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